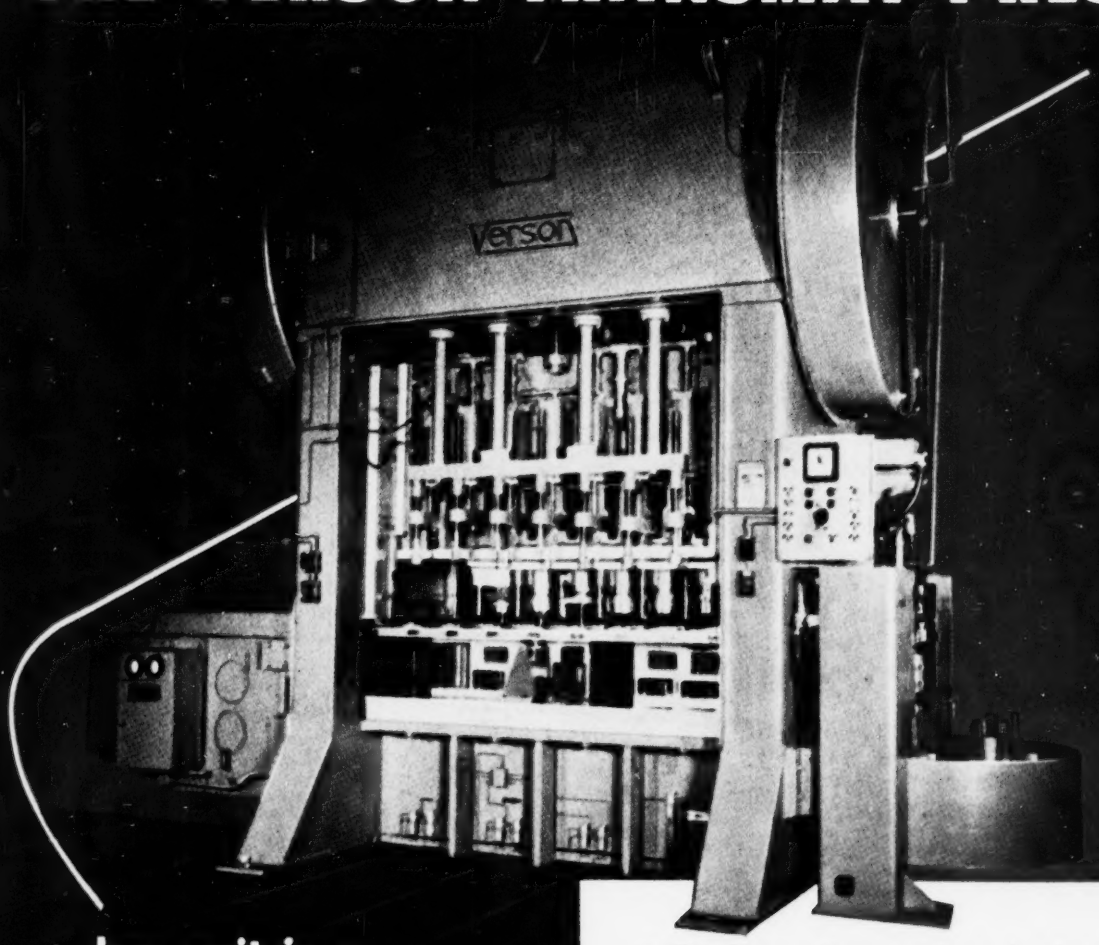
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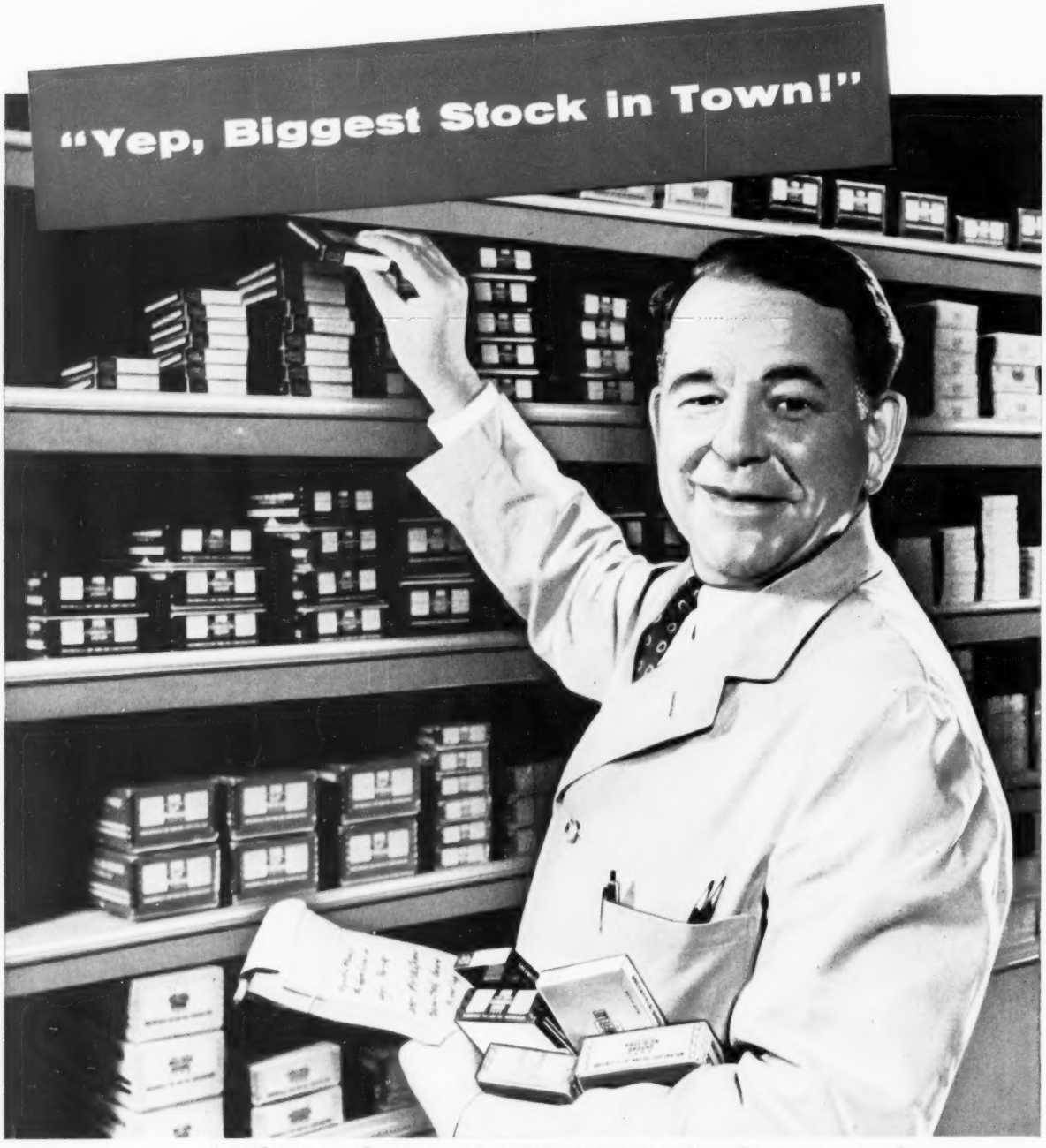


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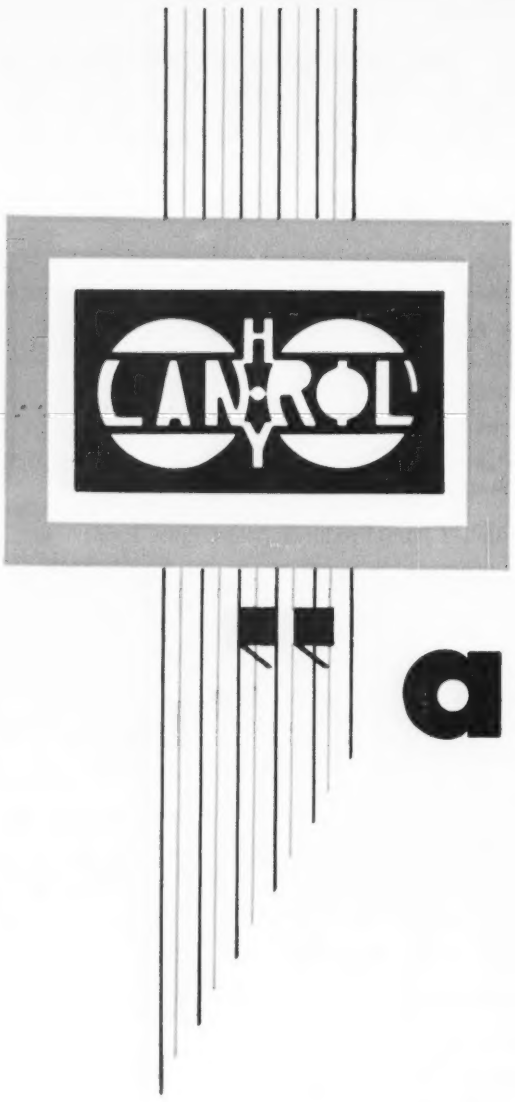
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threading service

With the addition of the LAN-HY-ROL Thread Rolling Machine, LANDIS offers a line of Threading Equipment unmatched by any other manufacturer. LANDIS Equipment is available for the production of threads by Cutting, Grinding, Rolling, or Tapping—Thread Cutting Machines, Die Heads and Collapsible Taps, Thread Grinders, Thread Rolling Attachments, and now Thread Rolling Machines.

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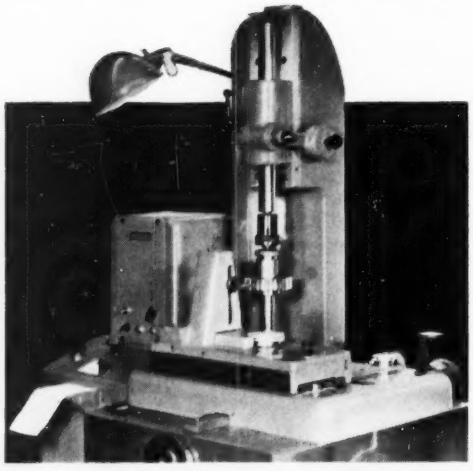
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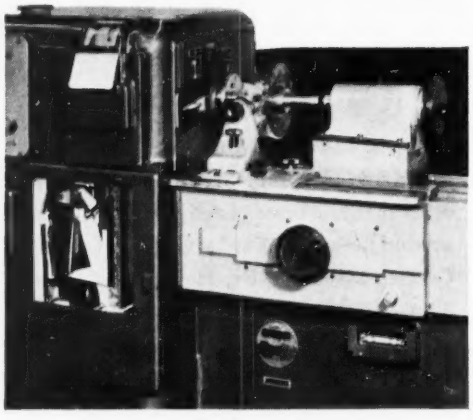
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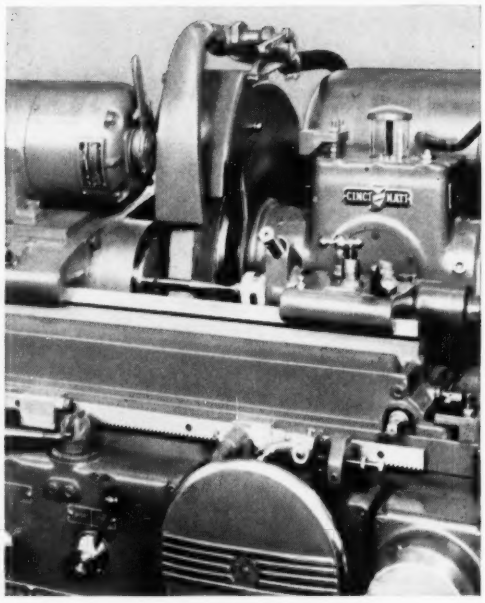
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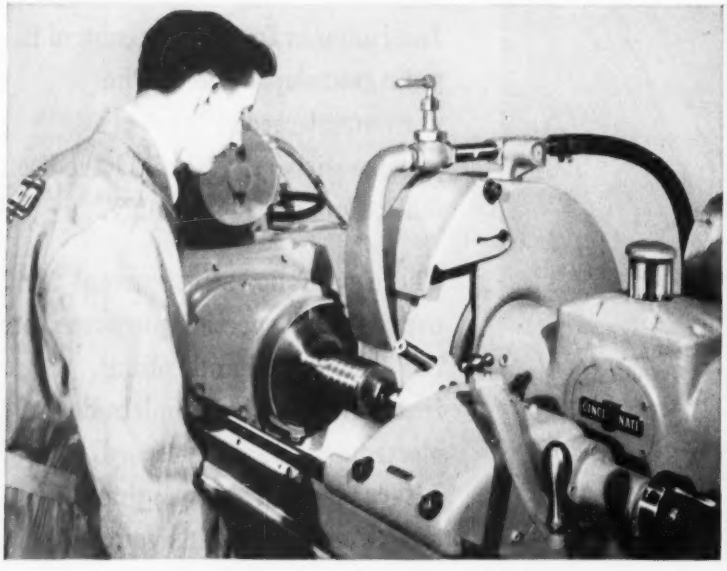
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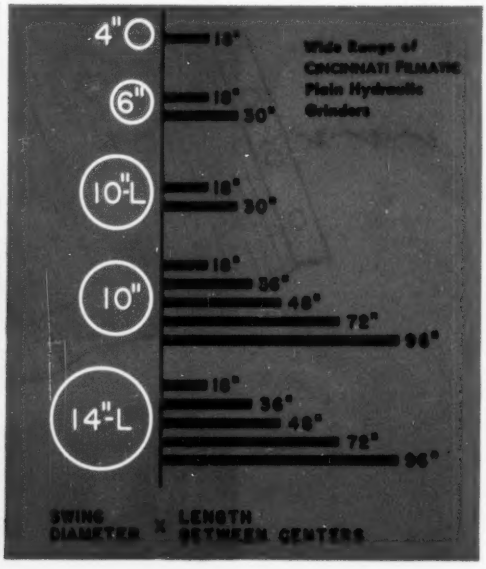
FILMATIC



Infeed grinding the bearing diameter of a cotton picker spindle, CINCINNATI FILMATIC 6" Plain Hydraulic Grinder.



Grinding a gang of collars mounted on an arbor. CINCINNATI FILMATIC 10" Plain Hydraulic Grinder.



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CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES

How much is it costing you to "stand pat" with your old centertype grinders? Chances are you could replace *half of them now with new machines, and immediately gain two big advantages:

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Subsidiary of The Cincinnati Milling Machine Co.

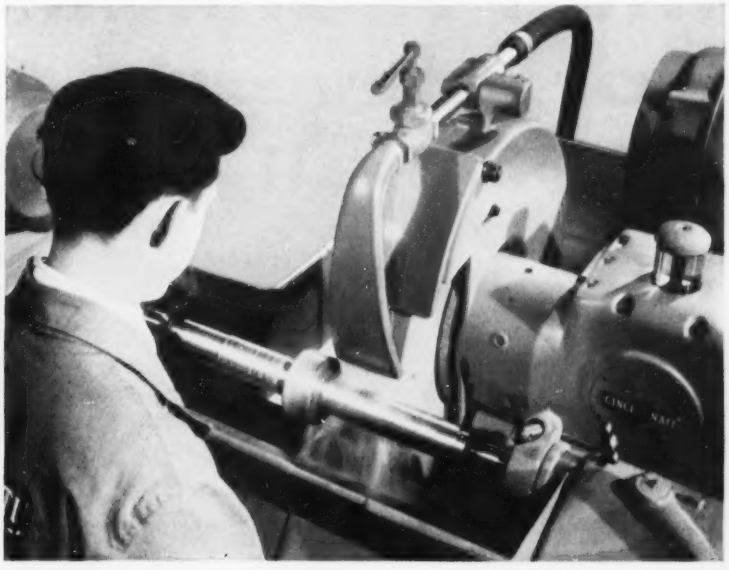
CINCINNATI 9, OHIO

**According to the most recent surveys, 60% of cylindrical grinding machines are over 10 years old. Most of them should be replaced.*

Grinding the sleeve diameter of a gear assembly. CINCINNATI FILMATIC 10" Plain Hydraulic Grinder.



Traverse grinding close to the shoulder of a shaft. CINCINNATI FILMATIC 10" Plain Hydraulic Grinder.



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...in Precision Plunge or Traverse Grinding of Small Parts—



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Work size 4" Diam. x 18" Long. Grinding Wheel 14" O.D. x 2" Wide. 3 H.P. Wheel Motor Optional.

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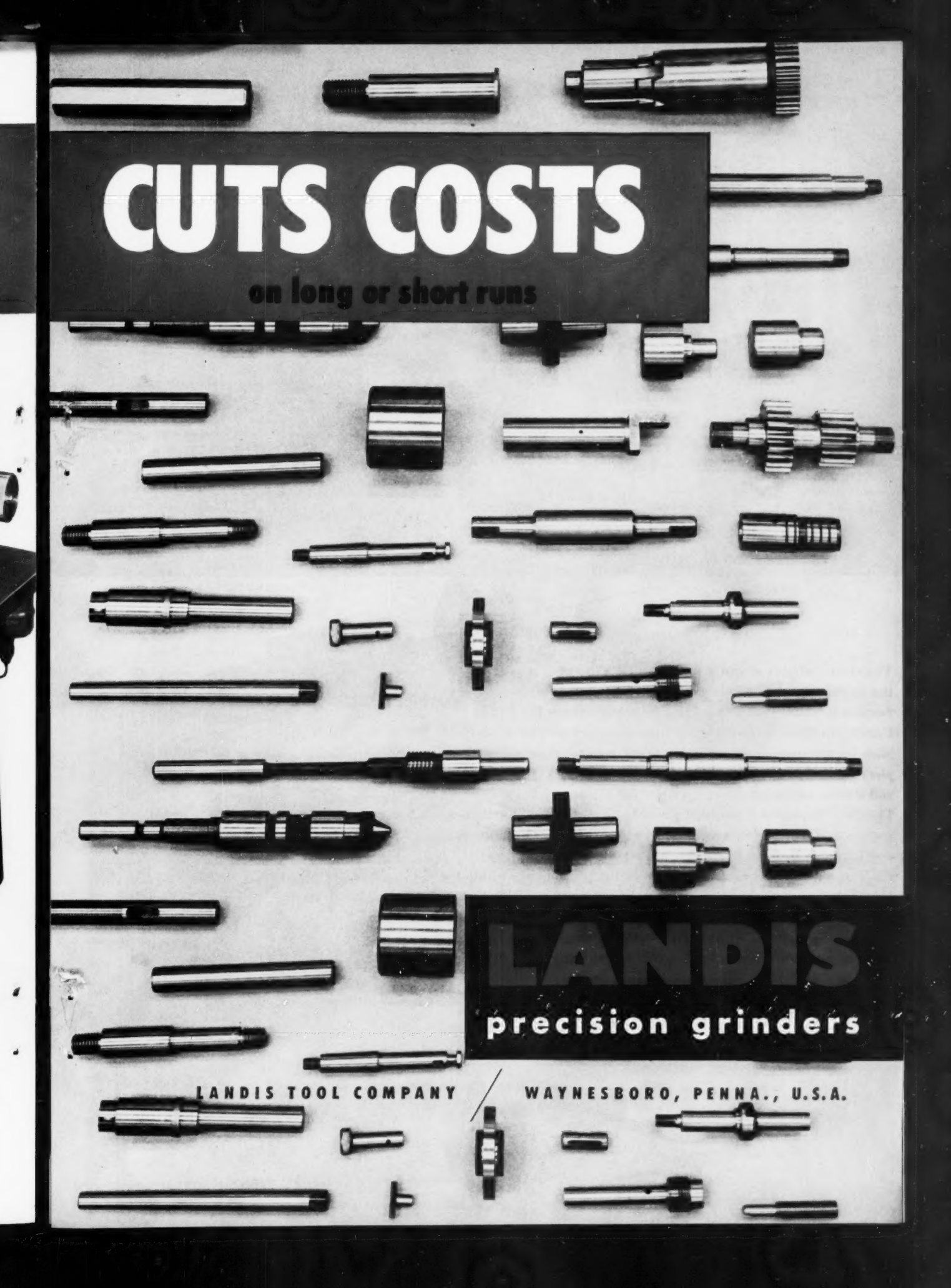
Cylindrical Grinder

VAN NORMAN COMPANY

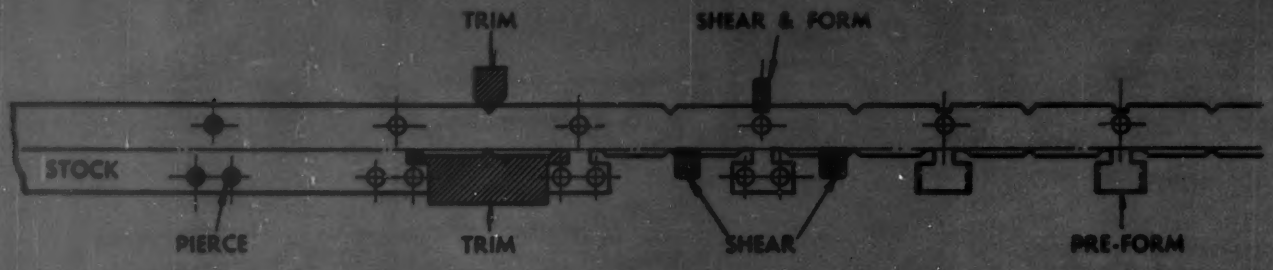
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on long or short runs
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Secondary Operations Eliminated! Formed Metal Stampings Produced Complete in the U. S. MULTI-SLIDE®





The electrical part shown actual size at the top of the opposite page is produced from coil stock—complete, without further handling—at a speed of 140 per minute in the No. 28 U. S. Multi-Slide ®. Another example of the advantages of the U. S. Multi-Slide for the precision fabrication of many types of metal parts calling for piercing . . . blanking . . . forming . . . swaging . . . embossing and similar operations!

The part illustrated is made of phosphor bronze .025" thick, and the sequence of operations is as follows: pierce 3 holes; trim top and bottom; shear on bottom; preform, cut off; finish form. The last operation is shown in detail in the profile view within the circle above.

In addition to eliminating costly secondary operations, U. S. Multi-Slides save manpower, too. A single operator can attend a battery of Multi-Slides, since the operation is entirely automatic. The operator merely loads coils of material onto a stock reel for feeding into the machine.

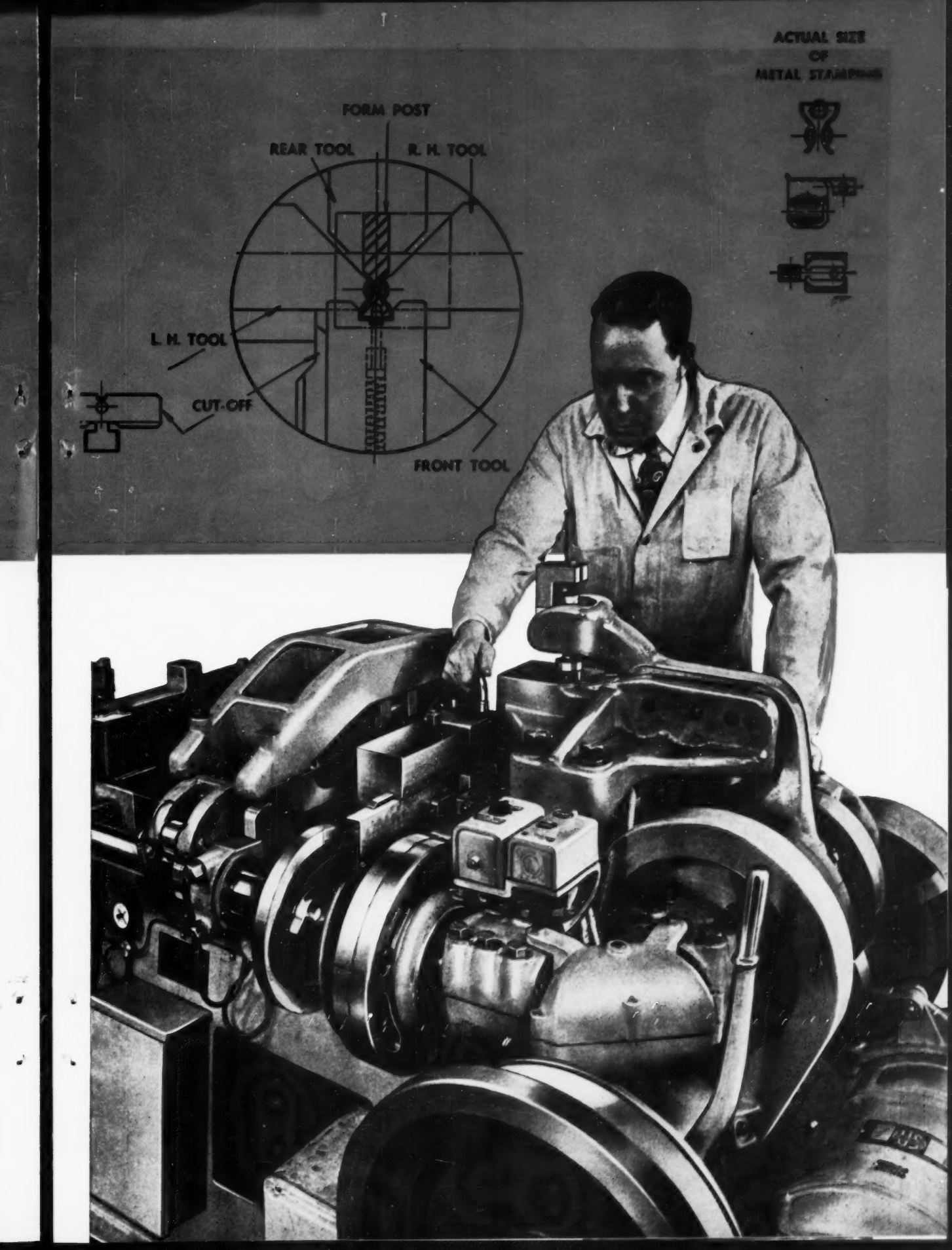
Perhaps some of the formed metal parts produced in your plant could be handled to greater advantage in the U. S. Multi-Slide. Bulletin 15-M contains complete details, and your inquiries are invited.

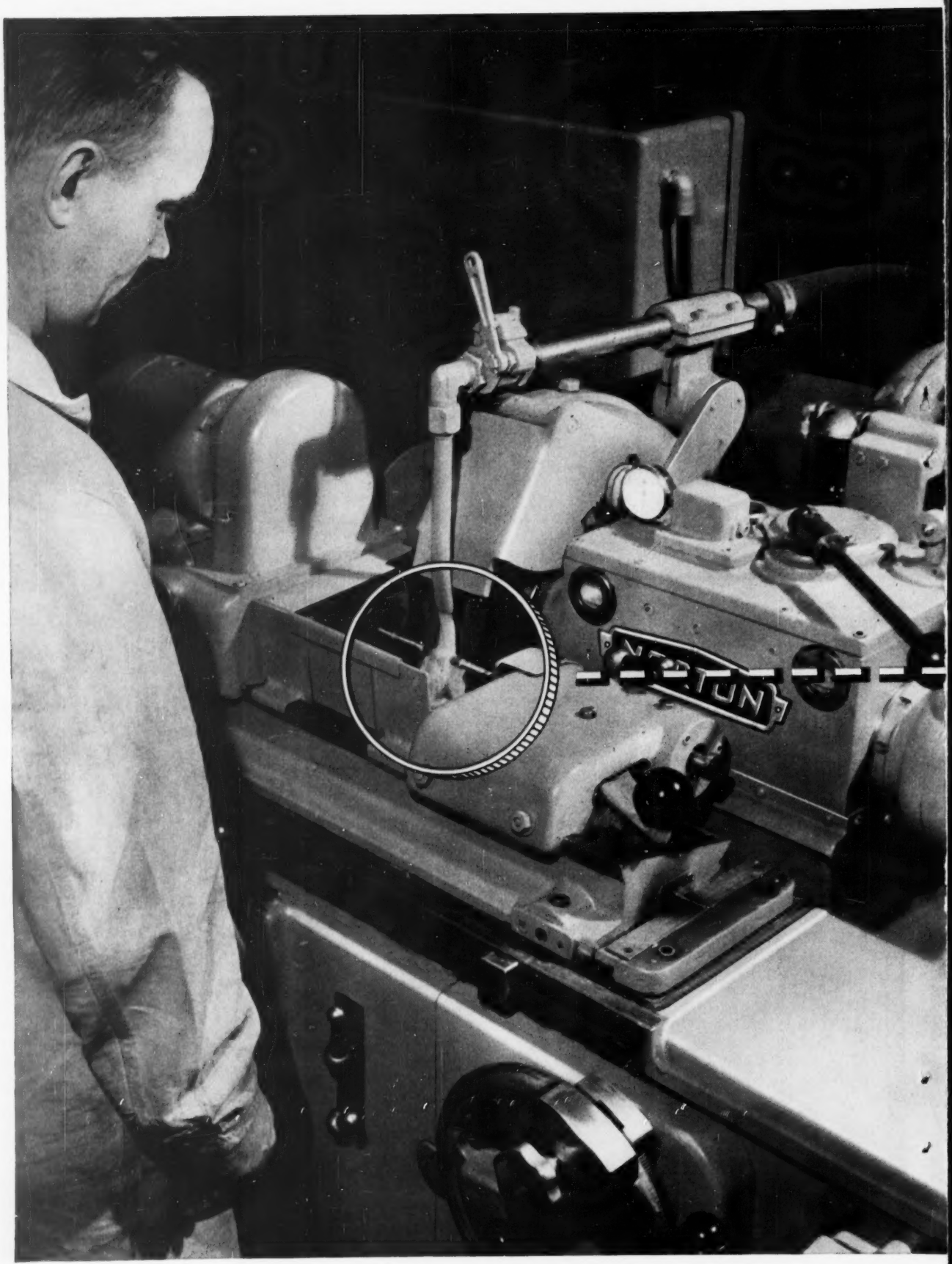
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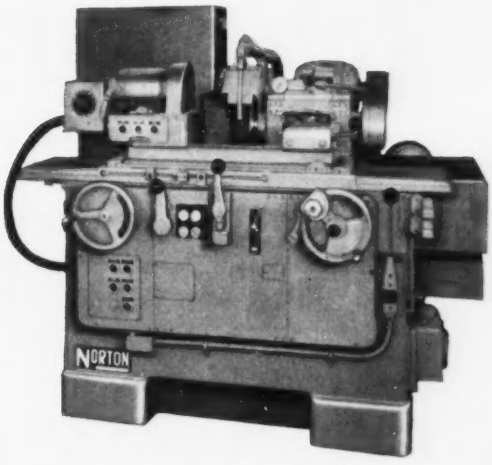
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Builders of U. S. Multi-Slides — U. S. Multi-Millers

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New Norton 4"x18" Type CTU Cylindrical Grinder

gives you high precision plus high production . . .

makes small parts pay off big

Here's a cylindrical grinder you can get as either a Plain Machine for traverse work, or as a Semiautomatic for plunge operations.

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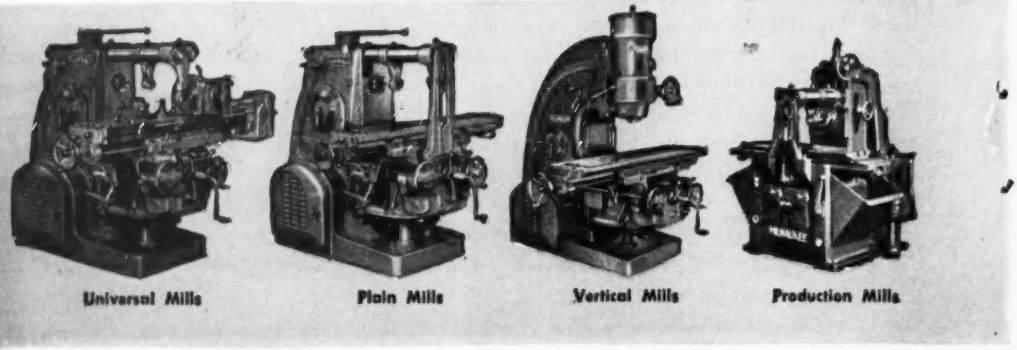
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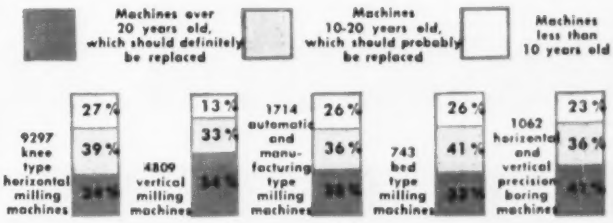


Universal Mills | Plain Mills | Vertical Mills | Production Mills

LET'S LOOK AT THE OBSOLESCENCE PICTURE IN THE METALWORKING MACHINERY INDUSTRY

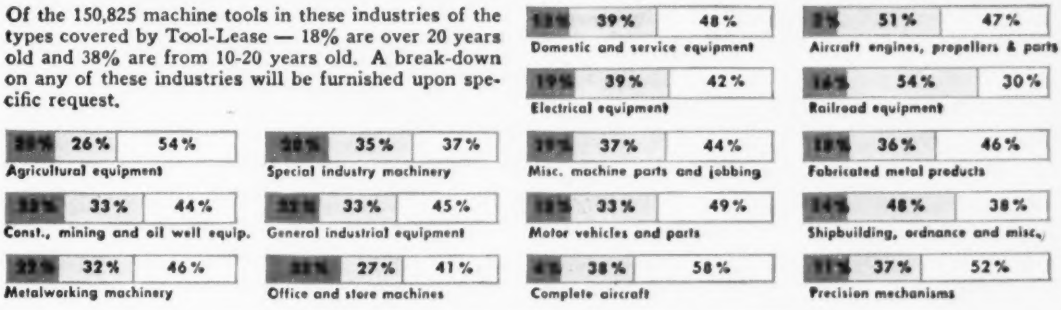


Here's the picture in a typical basic industry — MFG. OF METALWORKING MACHINERY — (see chart at right). Of the 18462 standard knee type horizontal, vertical, bed and manufacturing type milling machines and precision boring machines in use today — *which could be replaced by Tool-Lease* equipment — 32% are 10-20 years old, 22% are more than 20 years old!



HERE'S THE OVERALL PICTURE IN THE ABOVE AND 15 OTHER BASIC INDUSTRIES

Of the 150,825 machine tools in these industries of the types covered by Tool-Lease — 18% are over 20 years old and 38% are from 10-20 years old. A break-down on any of these industries will be furnished upon specific request.



Figures for this presentation adapted from 1953 McGraw-Hill survey of metalworking industry.

BY MODERNIZING WITH TOOL-LEASE YOU CAN ELIMINATE UNNECESSARY OVERHEAD

Kearney & Trecker's Tool-Lease Program offers operating management a quick way to stop the trend of rising costs increasing competition and shrinking profit margins. With Tool-Lease, you can enjoy optimum flexibility to meet changing production requirements while avoiding the risk of high obsolescence. What's more, Tool-Lease enables you to keep your plant modern without tying up working capital.

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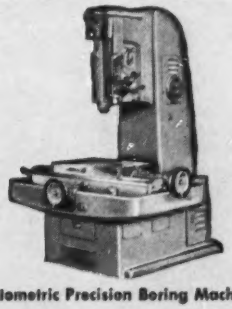
For complete information on Tool-Lease . . . help in analyzing your milling and/or precision boring needs — see your Kearney & Trecker representative or mail coupon to Kearney & Trecker Corp., 6784 W. National Avenue, Milwaukee 14, Wisconsin.

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Automatic Precision Boring Machines

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Please send me Bulletin TL-10A on Tool-Lease Program and booklet titled "Critical Picture of Creeping Obsolescence" or call Milwaukee, GReenfield 6-8300.



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You get 45 distinct standard equipment



Here's a highly skilled G&L craftsman making final adjustments in the spindle feed gears. All gears have been flame-hardened and precision ground to insure lasting precision . . . smooth, vibrationless positive power.

spindle speeds as with a G&L 30 Series



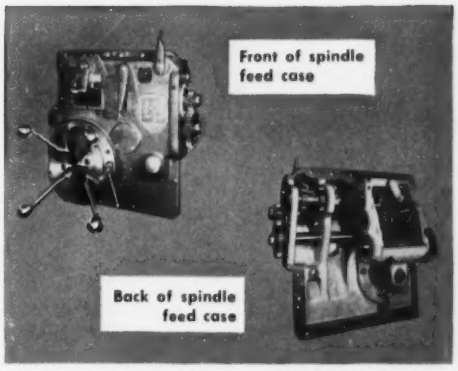
Only a G & L 30 Series table type Horizontal offers so many separate spindle speeds and positive all-geared spindle drive — plus the high torque and full power you need for efficient machining at low or high speeds.

THE engineering of a G&L 30 Series Horizontal Boring, Drilling and Milling Machine's headstock and spindle drive provides a perfectly balanced combination of versatility, efficiency and long-lived precision. With positive all-geared drive — 45 speeds in fine increments — are easy to select or change. Design of the gear train insures high torque at the cutter when working at lower speeds. And — at high speeds — the drive gear shifts and performs with a flywheel effect that provides maximum cutting efficiency of carbide tools. What's more, four gibs on the headstock assure maximum bearing surface, perfect alignment at all times.

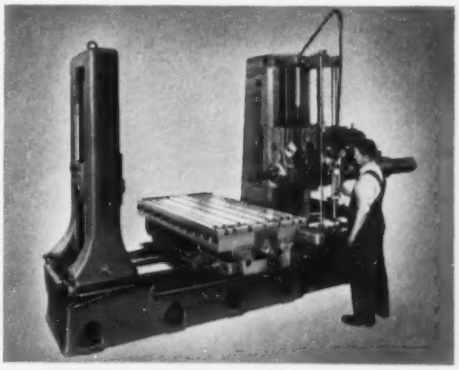
Check these other important advantages

Two of the many other additional advantages you get with a G&L 30 Series are (1) flame hardened and precision-ground bed and saddle ways which are standard equipment and, (2) the option of extended saddle, saddle supports and auxiliary runways which take the risk out of precision machining large workpieces that require the full range of the machine.

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Adjustable micrometer dial graduated in .001" provides fast, accurate spindle positioning. At right, dials beneath cover plate are geared to rotary selectors, show speed or feed engaged. While making selections, operator merely watches window until desired setting appears.



There are two basic models in the 30 Series — the 340-T with 4" spindle and 20 hp, or the 350-T with 5" spindle and 25 hp. Both machines offer a choice of three basic arrangements of table and saddle.

GIDDINGS & LEWIS MACHINE TOOL CO.

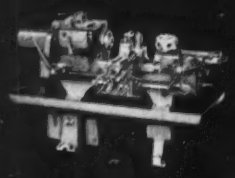
FOND DU LAC, WISCONSIN

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RAM TYPE TURRET LATHES



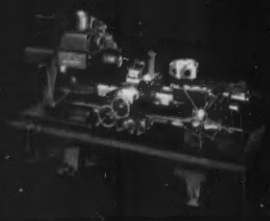
NO. 2 ALL-GEARED HEAD
1" Bar Capacity
14" Swing



NO. 3 UNIVERSAL
1½" Bar Capacity
15⅜" Swing

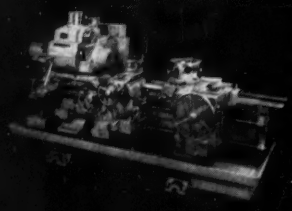


NO. 4 UNIVERSAL
2" Bar Capacity
18⅛" Swing

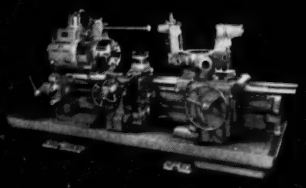


NO. 5 UNIVERSAL
2½" Bar Capacity
20" Swing

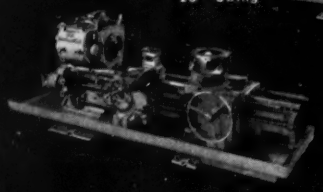
SADDLE TYPE TURRET LATHES



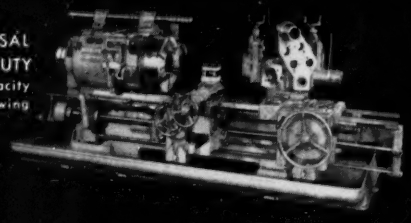
1-A UNIVERSAL
HEAVY DUTY
2½" or 3" Bar Capacity
16¼" Swing



2-A UNIVERSAL
HEAVY DUTY
3½" Bar Capacity
20" Swing



3-A UNIVERSAL
HEAVY DUTY
4½" or 6" Bar Capacity
23½" Swing



4-A UNIVERSAL
HEAVY DUTY
8" 9" or 12" Bar Capacity
28¼" Swing

PRECISION TAPPING AND THREADING MACHINES



NO. 10
TAPPING MACHINE
0-80 to 10-24 Capacity



NO. 11
TAPPING MACHINE
8-36 to ⅞" Capacity

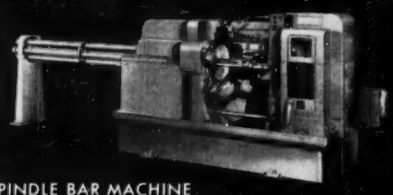


NO. 11 RS RADIAL (Single Head)
NO. 11 RD RADIAL (Double Head)
8-36 to ⅞" Capacity

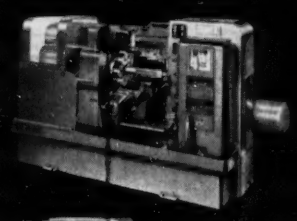


NO. 12
TAPPING MACHINE
⅛" to 2½" Capacity

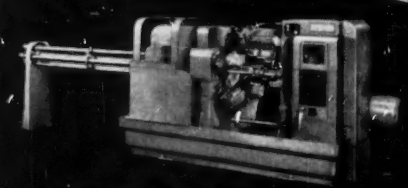
MULTI-SPINDLE AUTOMATICS



6-SPINDLE BAR MACHINE
¾" or 1¼" Bar Capacity



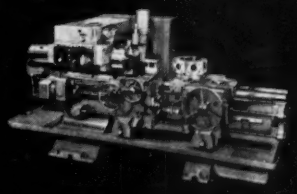
5-SPINDLE
CHUCKING MACHINE
6" Swing



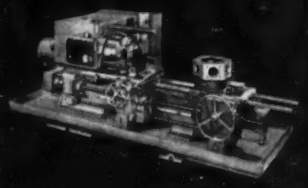
5-SPINDLE BAR MACHINE
1¾" Standard Bar Capacity
2¼" Oversize Capacity

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER &

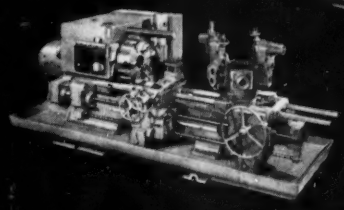
SADDLE TYPE TURRET LATHES



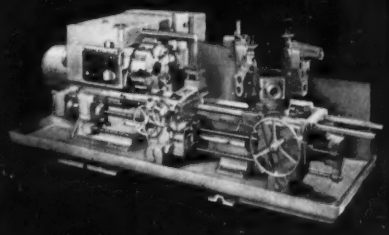
1-A UNIVERSAL
EXTRA-HEAVY DUTY
2½" or 3" Bar Capacity
16¼" Swing



2-A UNIVERSAL
EXTRA-HEAVY DUTY
3½" or 4½" Bar Capacity
20" Swing

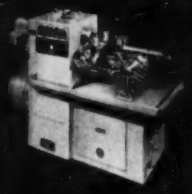


3-A UNIVERSAL
EXTRA-HEAVY DUTY
4½" or 6" Bar Capacity
23½" Swing



4-A UNIVERSAL
EXTRA-HEAVY DUTY
9" or 12" Bar Capacity
28¼" Swing

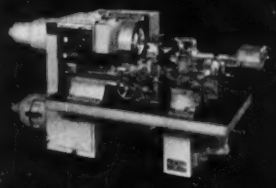
ELECTRO-CYCLES



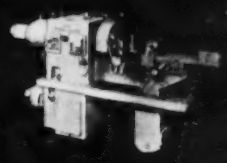
NO. 1 ELECTRO-CYCLE
⅝" Bar Capacity
11" Swing



NO. 2 ELECTRO-CYCLE
1" Bar Capacity
14" Swing

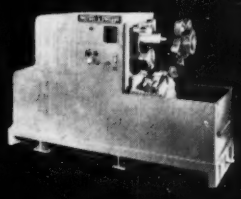


NO. 3 ELECTRO-CYCLE
1½" Bar Capacity
15⅜" Swing

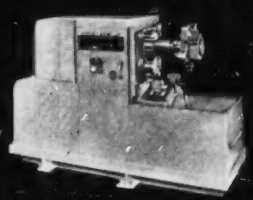


16" ELECTRO-CYCLE
1½" Bar Capacity
16⅞" Swing

SINGLE SPINDLE AUTOMATICS



1 AC CHUCKING MACHINE
8" or 10" Chuck — 6" Working Stroke



2 AC CHUCKING MACHINE
10" or 12" Chuck — 9" Working Stroke

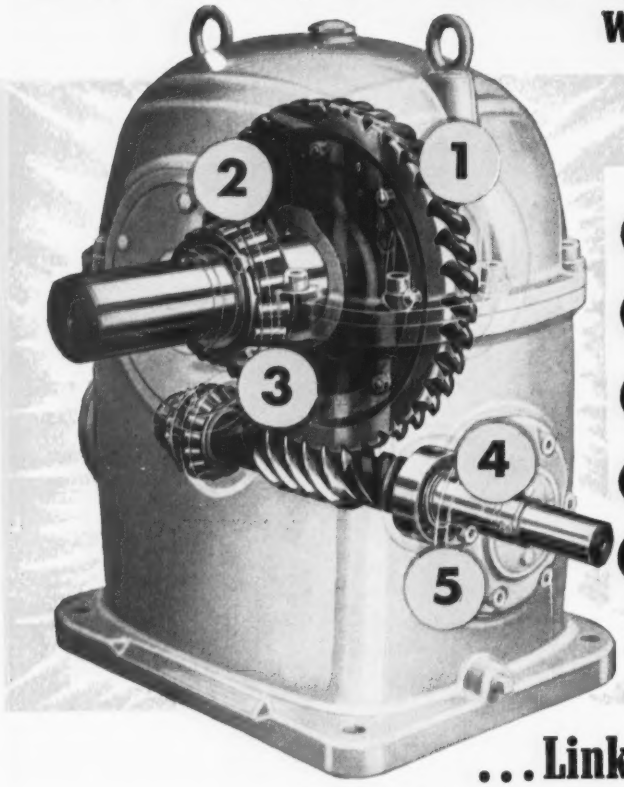
When the going gets tough ...put it on a WARNER & SWASEY



WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

When your speed reduction job calls for high ratios with right-angle takeoff...



1. **NICKEL-BRONZE WORM GEARS,** chill cast in dry sand, combine low coefficient of friction with high tensile strength.
2. **HIGH-CAPACITY ROLLER BEARINGS** take both thrust and radial loads. Lower wear and friction losses reduce maintenance.
3. **ALL-SPEED EFFICIENCY** results from reduced sliding action between worm threads and gear teeth, plus smoother power delivery.
4. **ONE-PIECE FORGED SHAFTS** are alloy steel, carburized and heat-treated for great impact resistance.
5. **AUTOMATIC SPLASH LUBRICATION** reliably supplies oil to all bearings and gear teeth at all speeds.

...Link-Belt gives you

everything you want in WORM GEAR DRIVES

With their compact, high-strength design, Link-Belt Worm Gear Drives permit high-ratio speed reductions in small space. High input speeds and low output speeds are provided, with ample capacity for heavy loads.

Three basic types cover the complete field of application: Single worm gear drives, helical worm gear drives and double worm gear drives. All are available with either horizontal or vertical shafts, and single or double gear reductions for convenient and compact connection.

Link-Belt Worm Gear Drives are available in 3.1:1 to 8000:1 reduction ratios, 1400 to 123,000 in. lbs. torque—0.22 to 564 output shaft rpm. Ask for Book 2324-A.

LINK-BELT 13.402

ENCLOSED GEAR DRIVES

WHY PRE-INTEGRATED LINK-BELT DRIVES CUT YOUR POWER TRANSMISSION COSTS

In addition to all three types of enclosed gear drives, Link-Belt builds variable speed drives, fluid drives—chains, sprockets, couplings, bearings, shafting, etc. All are pre-engineered for easy installation and maximum efficiency.



Gearmotors —ask for Book 2247

Helical Gear Drives —ask for Book 2451

Parallel Shaft Gear Drives —ask for Book 2519

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office: New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

For more information on products advertised, use Inquiry Card, page 241

HOW A HARDER GRADE ABRASIVE INCREASED DISC LIFE 10 TIMES

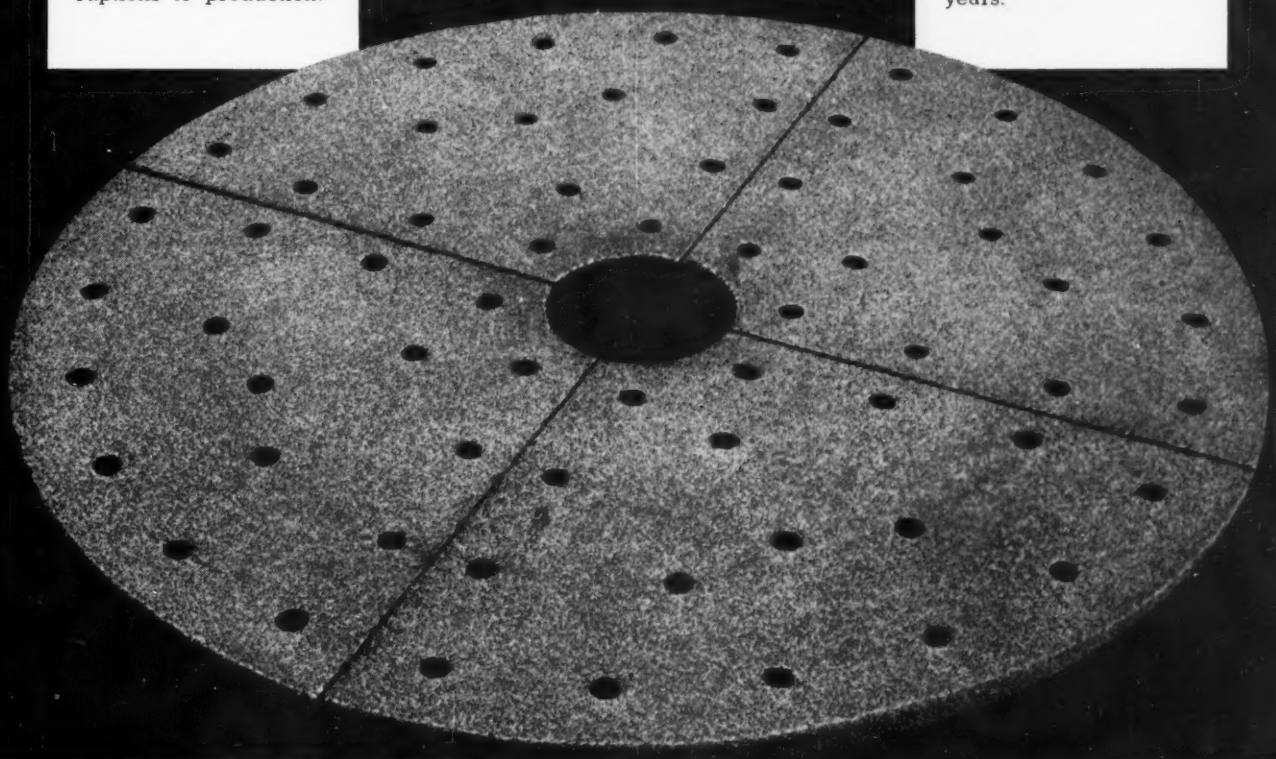


The Problem

An ordinary type of segmental disc had to be replaced after snag grinding only 51,000 automobile cylinder blocks on a Gardner Horizontal Disc Grinder. The short disc life caused high abrasive costs and interruptions to production.

The Solution

The Gardner Abrasive Specialist recommended a YELLOW-RIM segmental disc of a much harder grade. This new disc has already ground more than 250,000 cylinder blocks and is expected to grind 250,000 more in the next two years.



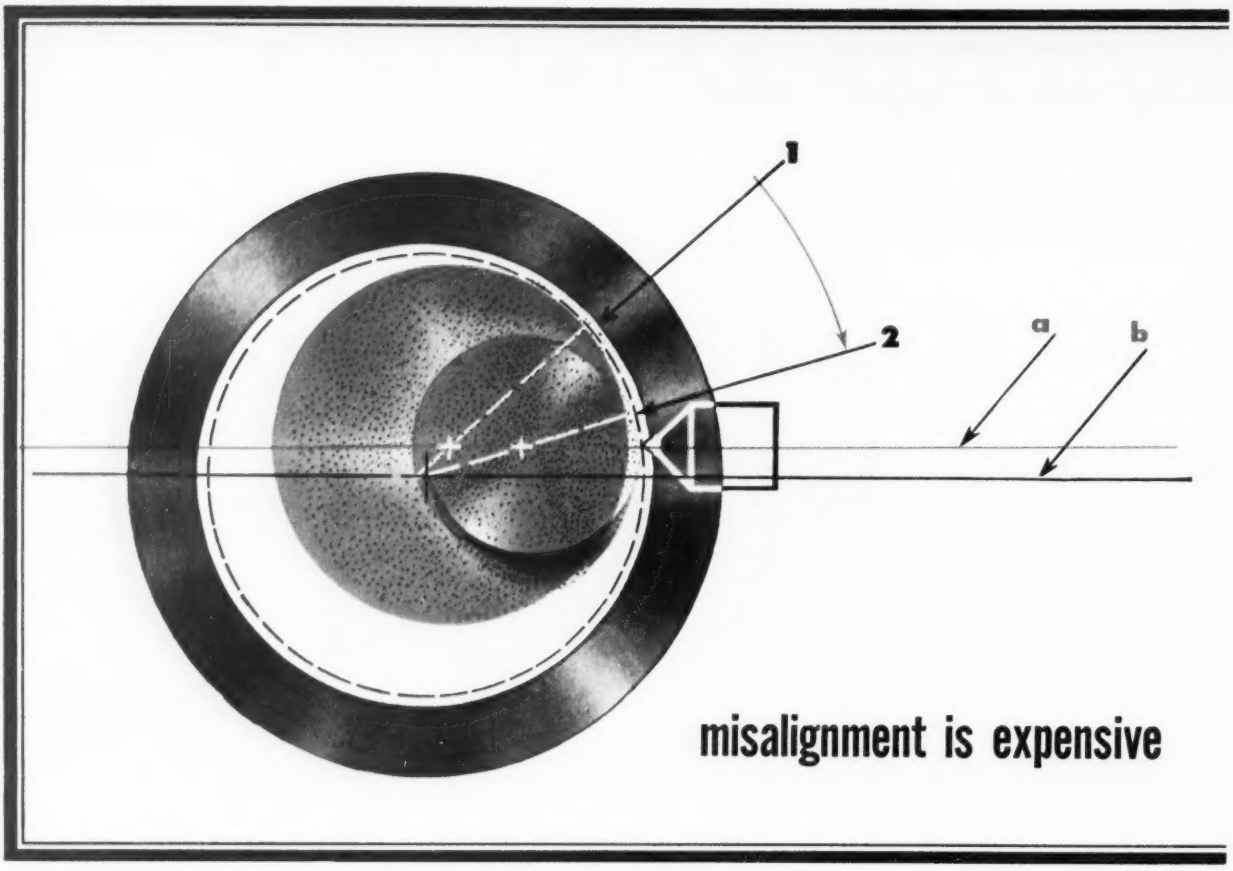
If you encounter problems in flat surface grinding Gardner Abrasive Specialists can help you solve them. They have experience gained from making both the grinding machines and the abrasive discs.

For help with *your* grinding problems, consult the Gardner Abrasive Man.

GARDNER MACHINE COMPANY
414 Gardner St., Beloit, Wisconsin, U.S.A.

GARDNER
abrasive discs

116A



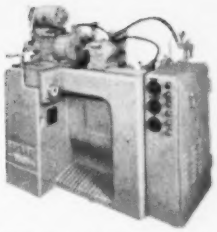
...Bryant controlled alignment

IF the internal grinder is to generate straight holes within precision tolerances, on a production basis, the various elements of the machine must be properly aligned. The axis of the work, the axis of the wheel, and the diamond must be in a plane parallel with both traverse and cross feed ways. Then the direction of feed will coincide with the line from the center of the workpiece to the point of contact between the wheel and the work, and the wheel will be dressed in line with its point of contact with the work regardless of the size of the wheel.

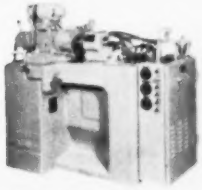
In the illustration above, these requirements are not met because the work center "b" is below plane "a" established by the wheel axis and the diamond. The drawing shows the wheel at its largest diameter (new) and also at its smallest diameter (worn). The difference between center heights "a" and "b" is constant during the life of the wheel. The position of the diamond remains constant for the life of the wheel. When the large wheel is dressed by the diamond it will contact the work at a point established



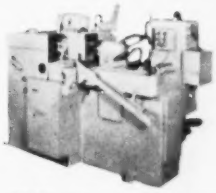
Write for "Alignment" booklet which gives complete details on this interesting subject. Also ask for booking form on new sound, color movie—free showings arranged for engineering groups.



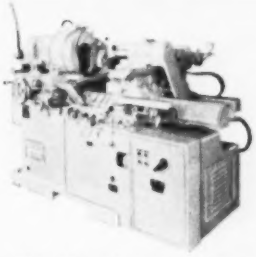
no. 1109 9″ swing, semi-automatic



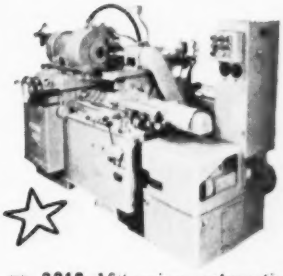
no. 1309-W 9″ swing, 2 spindle semi-automatic



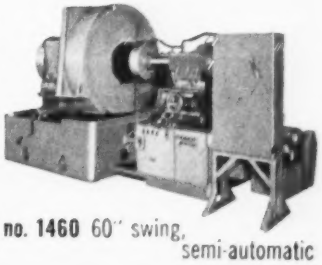
no. 2209 9″ swing, automatic



no. 1116 16″ swing, semi-automatic



no. 3216 16″ swing, automatic



no. 1460 60″ swing, semi-automatic

☆ The Bryant 3216 Automatic Internal Grinder is designed specifically for high production precision grinding and with minimum operator attention. All machine motions are hydraulically actuated. The 16″ swing permits grinding of straight and tapered holes in large diameter work to a maximum depth of 9″. The workhead can be swiveled to grind tapers up to 60° included angle. The entire grinding cycle of rough grind, dress and finish grind proceeds automatically and operator attention is required only for loading and unloading of work pieces and starting the cycle. Write for folder.

gives better internal grinding

by a line from the center of the work through the center of the wheel (position 1). When diamond sizing, the work, or wheel, is fed to a predetermined position. As the wheel wears down, it will continue to contact the diamond at the same point during dressing, but the small wheel will contact the work at position 2 and the size of the finished hole will be substantially smaller.

As the wheel wears, the point of contact between wheel and work will move gradually from position 1 down to position 2, and the size of the finished hole will become progressively smaller. This is one of the reasons that some internal grinders, when set up for diamond sizing, will not hold size during the life of the wheel. Many operators attempt to compensate for this error by constantly adjusting the diamond. The correct remedy would be to bring the axis of the work, the axis of the wheel and the diamond all into a common plane parallel with both traverse and cross feed ways. Finish size will then be correct regardless of wheel diameter.

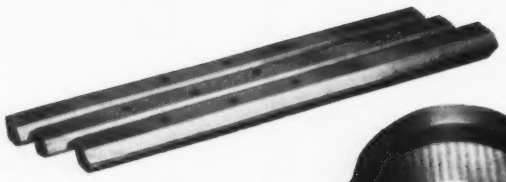
see our catalog in MACHINE TOOL CATALOGS or write for copy

Bryant Chucking Grinder Co.

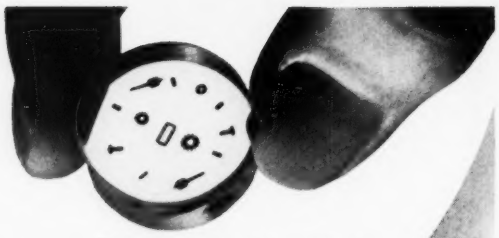
Springfield, Vermont, U. S. A.

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates

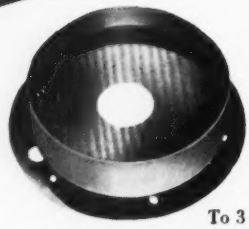
For more information on products advertised, use Inquiry Card, page 241



Hardened steel machine tool ways, 2½" x 3½" x 50", ground on 6 sides, flat within .001" with surface finish of 5 micro-inches—*5 times faster than other methods!*



Tiny watch gears, pinions and ruby bearings—flat and parallel—to a dimension tolerance of .0002".



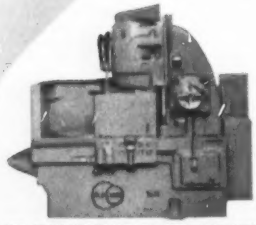
To 3 micro-inches and flat within *one* light band.

Die plates, 84" across corners and perhaps 24" thick, holding flatness to .001".



"Specs" like these call for Blanchard





NO. 18 BLANCHARD SURFACE GRINDER

Every day, parts like these are ground accurately and rapidly on Blanchard Surface Grinders equipped with Blanchard Abrasive Wheels. They're ground economically too—at costs which help you set competitive prices.

Send a sample of your parts for free test grinding and recommendations.



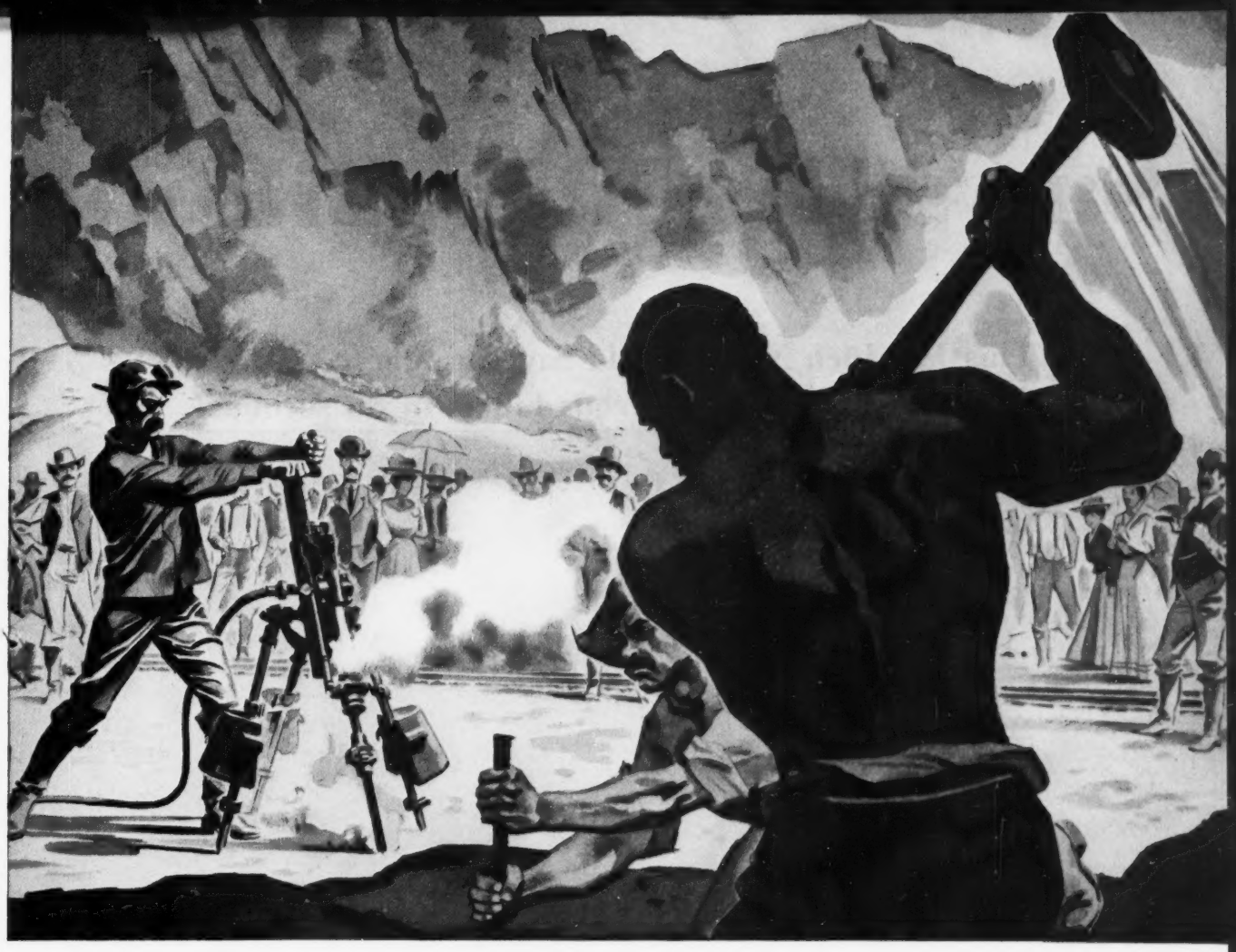
Send for your free copies of "Work Done on the Blanchard", fourth edition, and "The Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

For more information on products advertised, use Inquiry Card, page 241



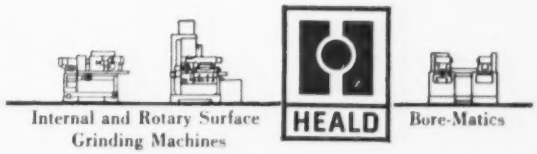
Machine vs. muscle — a duel to the death!

COMPETITION was *mighty* rough on the great Jawn Henry, famed steel-driving rock driller of the last century. For he pitted his strength against a steam-driven drill and *won*—only to die, hours later, from the strain. And the steam drill (later converted to air) replaced all hand methods of drilling rock.

The old order changes, yielding place to new and better ways of doing things. For competition and progress go hand in hand.

In today's highly competitive market, it's important that improved production methods be utilized to the fullest possible extent. That's where we can help. For Heald offers a potent combination of fresh thinking and sound experience in every phase of precision finishing. New developments in automation, way-type and transfer Bore-Matics, interchangeable tooling and improved internal grinding methods are just a few of the ways in which Heald may be able to solve your specific problems.

Competition is wonderful when you're *ahead* of it. Our business is to keep you there. That's why IT PAYS TO COME TO HEALD.



Internal and Rotary Surface Grinding Machines

Bore-Matics

THE HEALD MACHINE COMPANY

WORCESTER 6, MASSACHUSETTS

Offices in Chicago • Cleveland • Dayton
Detroit • Indianapolis • New York

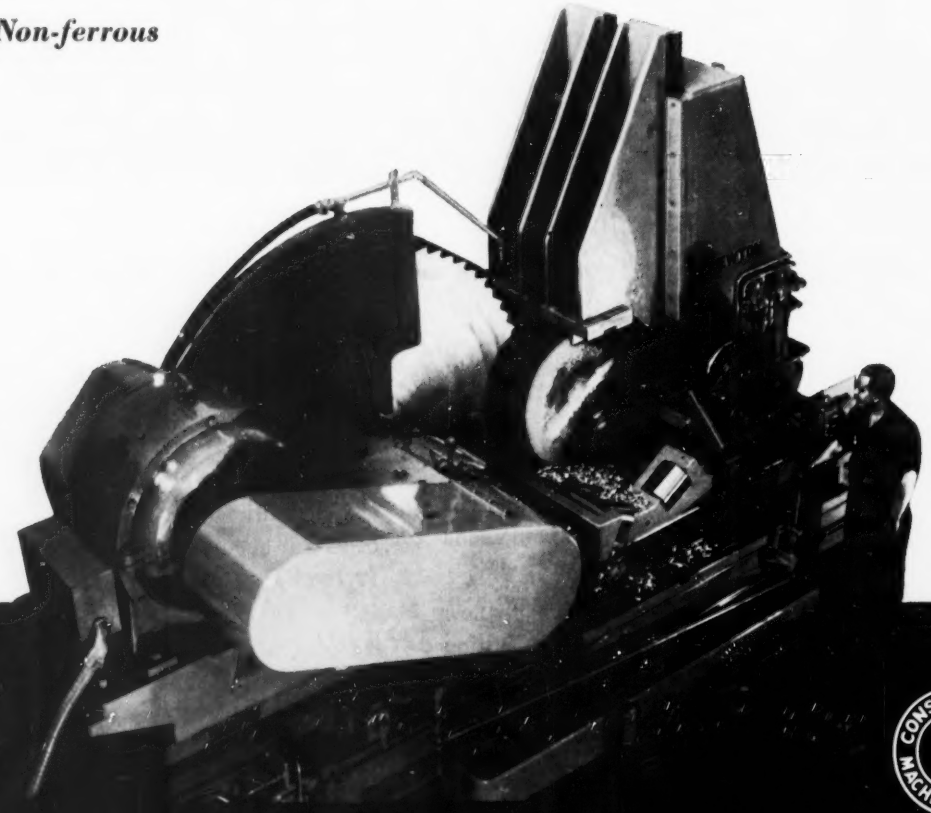
Saws Big N.F.* Billets

This 108 Inch Newton Cold Saw saws these 34 inch diameter non-ferrous billets in 80 seconds!

Its 100 H.P. motor whirls 9 foot diameter saw discs up to mile-a-minute cutting speeds in non-ferrous metals!

This is a big saw. It weighs 50 tons! But Consolidated also builds larger saws and smaller ones.

**Non-ferrous*

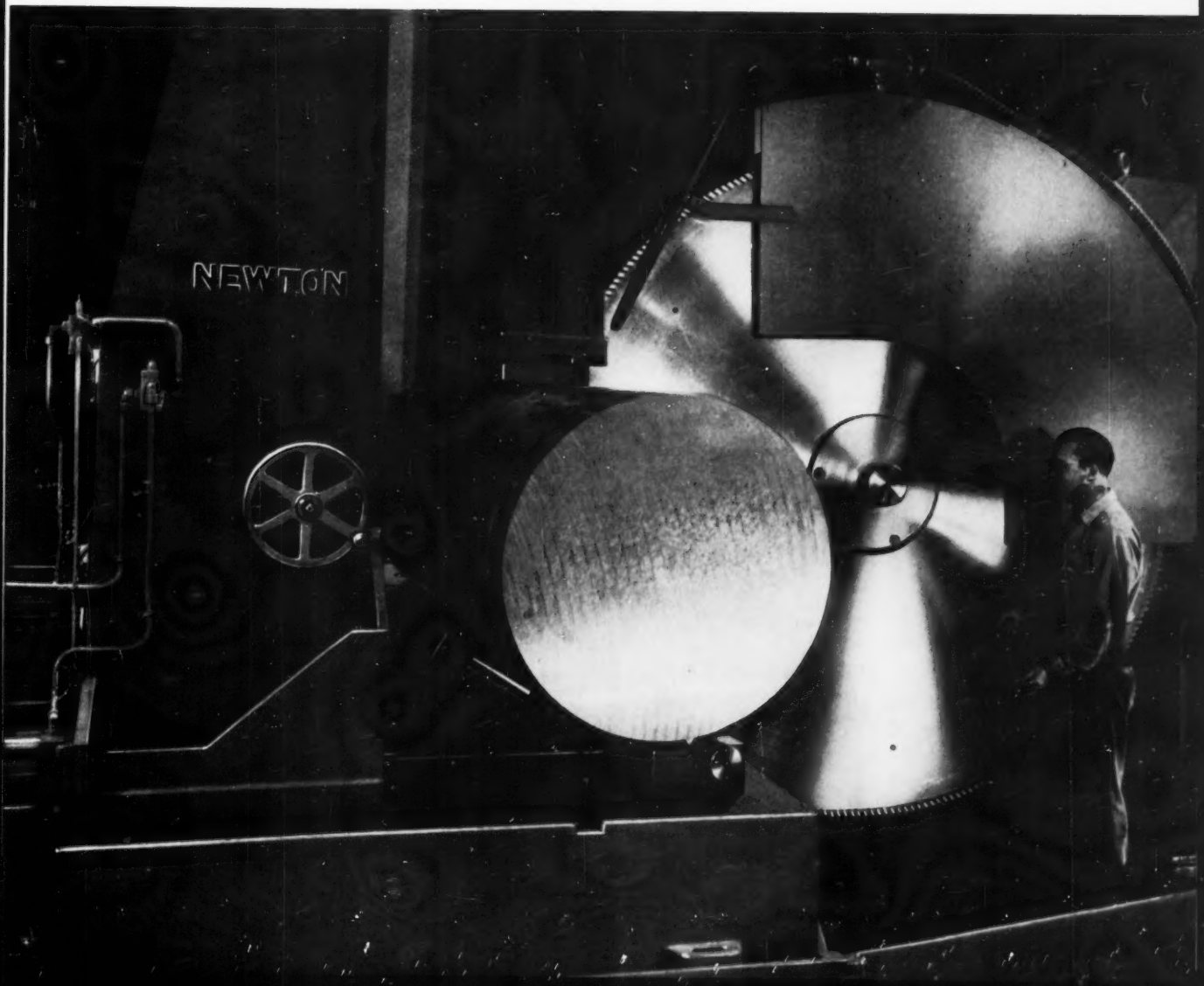


CONSOLIDATED MACHINE TOOLS

CONSOLIDATED MACHINE TOOL

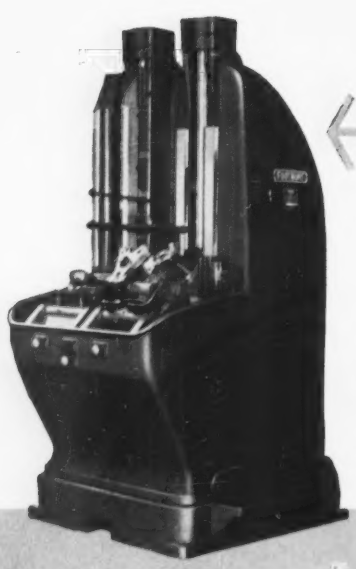
Wholly owned subsidiary of Farrel-

Like Cordwood!

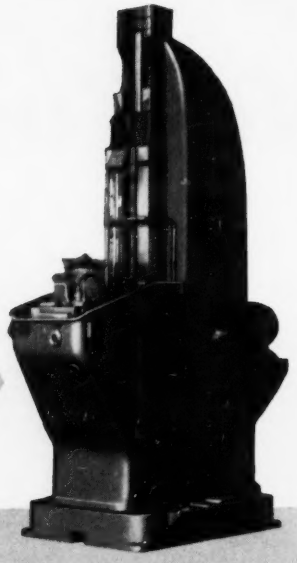


CORPORATION, ROCHESTER, N. Y.

Birmingham Company, Incorporated



Duplex Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.



Single Slide Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.

A FASTER *more economical* MACHINING OPERATION

● Footburt Surface Broaching may be the answer to your problem of faster machining. Many jobs that were slow and expensive when handled by conventional machining methods are now being produced by Surface Broaching. Production in most cases is as fast as the speed at which parts can be loaded. Yet cutting speeds are so low that the cost of tool maintenance shows great savings. Exceptional finish can be maintained. We will gladly discuss your machining problems with you.

THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building



Continuous Type Broaching Machine. Made in 5 Sizes.

FOOTBURT

SURFACE BROACHING

For more information on products advertised, use Inquiry Card, page 241



The COLD FACTS about a RED HOT discovery

CIMCOOL with "95-59" eliminates rancidity and foul odors

Actual scientific laboratory and shop tests prove—beyond any doubt—that CIMCOOL® with "95-59" eliminates rancidity and foul odors . . . and is positively non-irritating to the skin!

CIMCOOL is giving the cold shoulder to old-fashioned coolants in more and more plants every day because this radically new and different cutting fluid is a *chemical emulsion.* The amazing ingredient "95-59" is a more effective bactericide, is non-corrosive and eliminates rancidity and foul odors—*even in the hottest weather.* And CIMCOOL, in contrast with old-fashioned cutting fluids, can be kept at work longer. Thus, CIMCOOL greatly reduces downtime and labor costs for cleaning and changing.

For a demonstration in your own machines, just write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.



®Trade Mark Reg. U.S. Pat. Off.

CIMCOOL for 85% of all metal cutting jobs

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.



. . . *but*

Experience Cannot be Copied

More than a quarter-century ago MARVEL invented and basically patented the MARVEL High-Speed-Edge Hack Saw Blade—the UNBREAKABLE blade that increased hack sawing efficiency many-fold.

Every MARVEL Hack Saw Blade ever sold has been of that basic welded high-speed-edge construction, with constant improvements from year to year, as EXPERIENCE augmented the "know-how" . . .

MARVEL is not "tied" to any single source of steel supply, and has always used the best high speed steels that became available from time to time as metallurgy progressed. When-as-and-if finer steels are developed—and are proven commercially practical for welded-edge hack saw blades—MARVEL will use them, regardless of cost or source . . .

There is only one genuine MARVEL High-Speed-Edge! All other "composite" or "welded-edge" hack saw blades are merely flattering attempts to imitate — without the "know-how" of MARVEL EXPERIENCE . . .

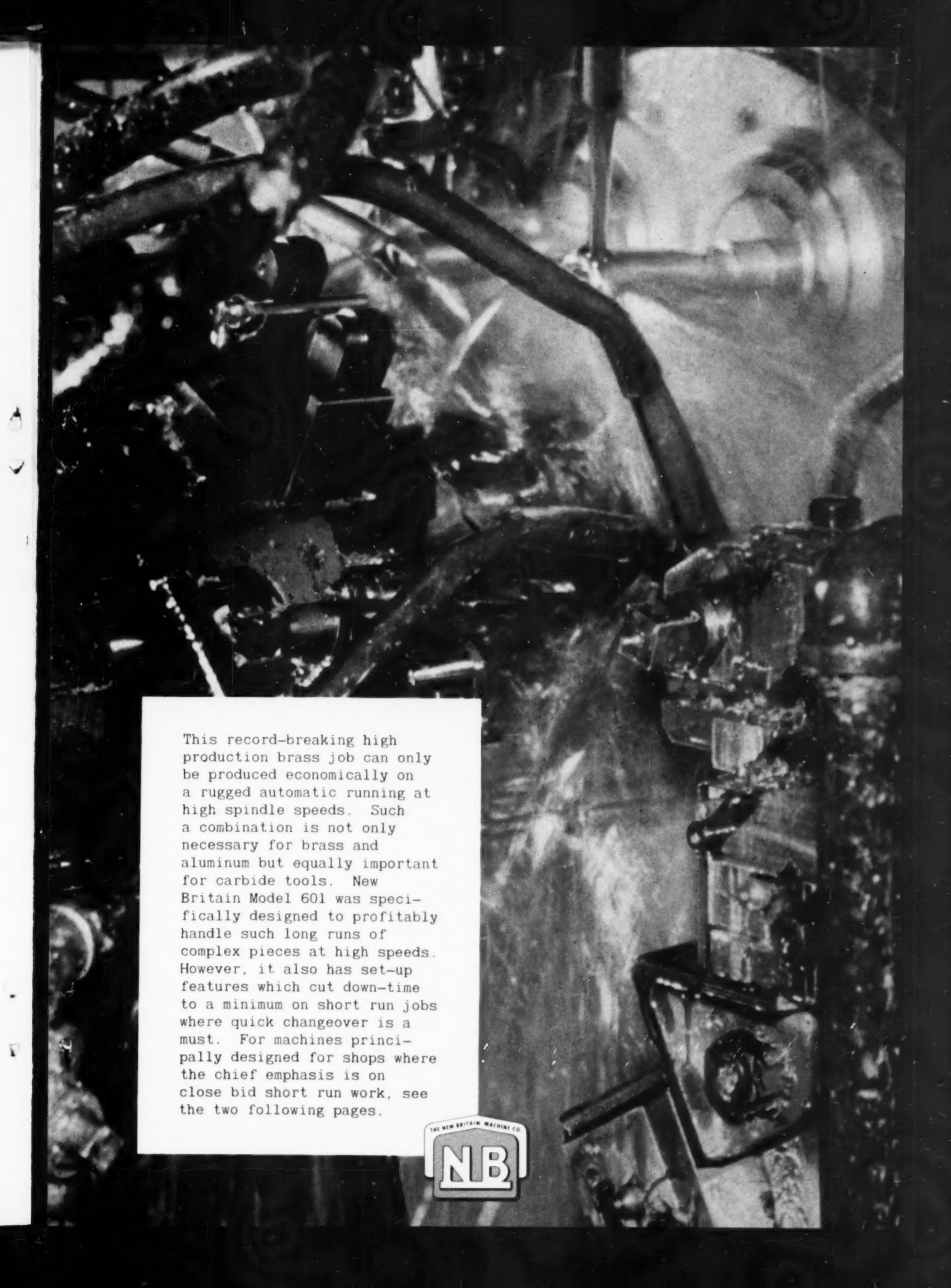
Insist upon *genuine* MARVEL High-Speed-Edge when buying hack saw blades—and be SAFE, for you can depend upon MARVEL. They have been "tested", "pre-tested", and "re-tested" by thousands of users for more than a quarter-century!

MARVEL *Metal Cutting* SAWS

Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Ave. • Chicago 39, U. S. A.

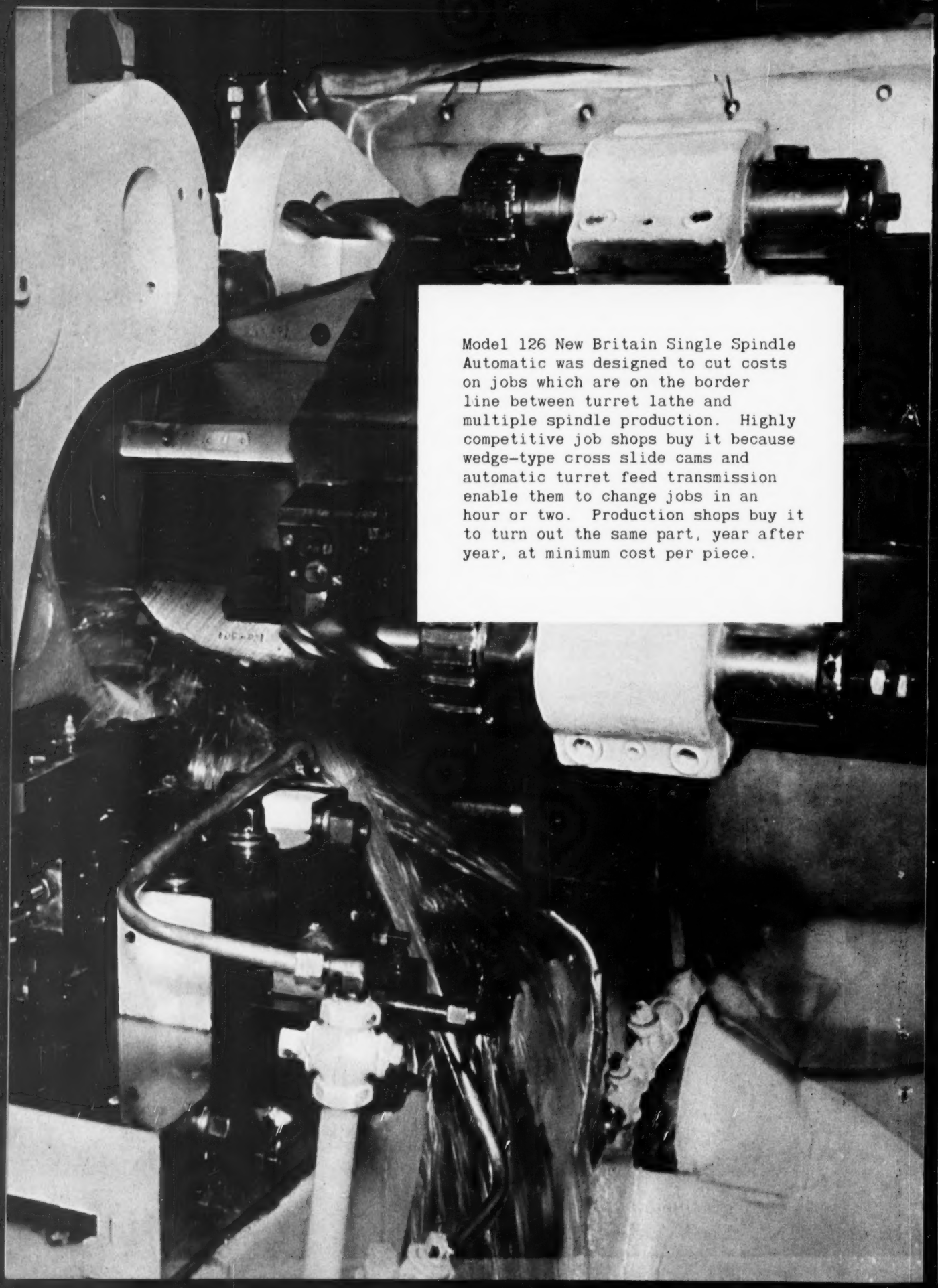
For more information on products advertised, use Inquiry Card, page 241



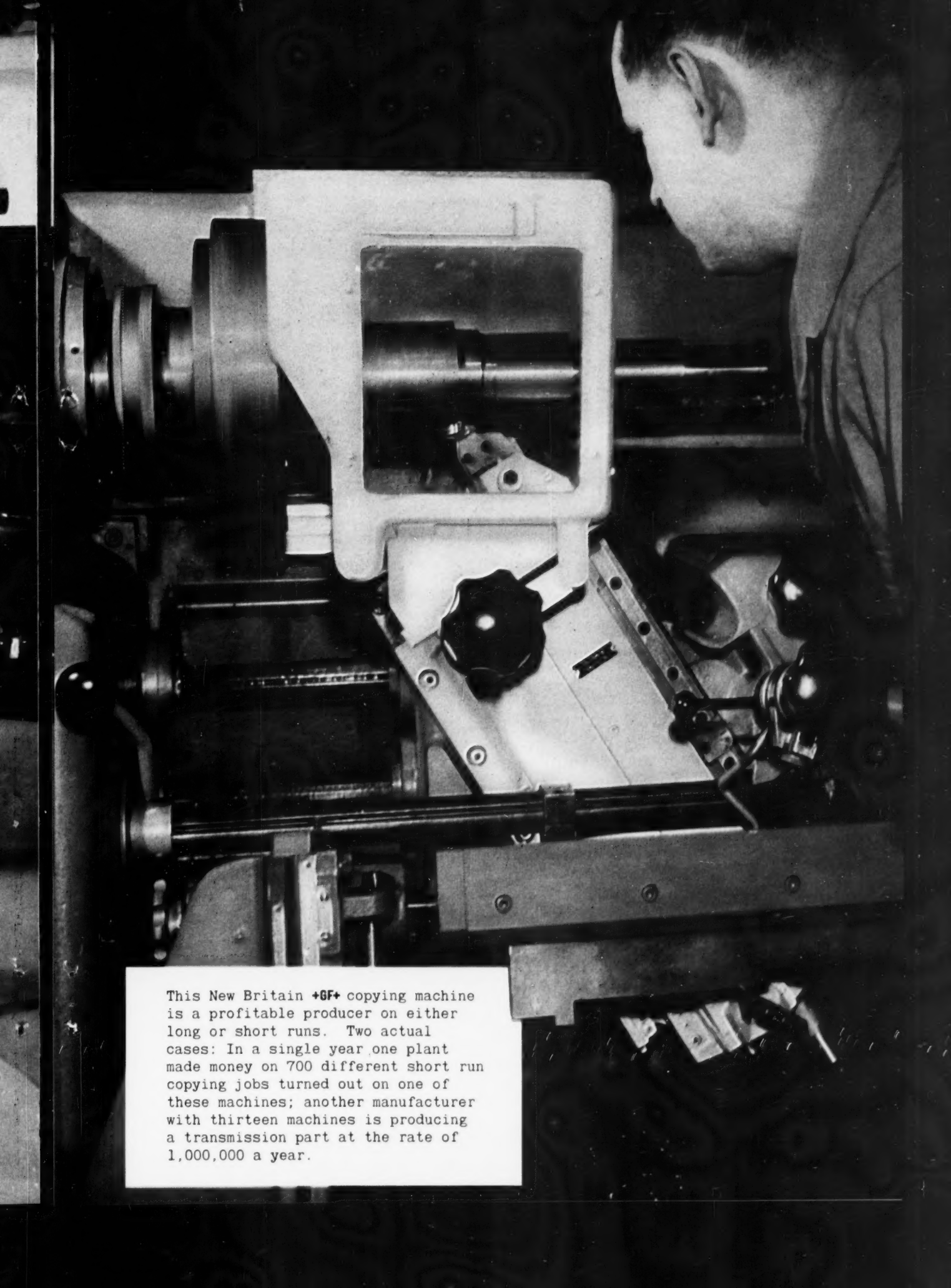
This record-breaking high production brass job can only be produced economically on a rugged automatic running at high spindle speeds. Such a combination is not only necessary for brass and aluminum but equally important for carbide tools. New Britain Model 601 was specifically designed to profitably handle such long runs of complex pieces at high speeds. However, it also has set-up features which cut down-time to a minimum on short run jobs where quick changeover is a must. For machines principally designed for shops where the chief emphasis is on close bid short run work, see the two following pages.

THE NEW BRITAIN MACHINE CO.

NB



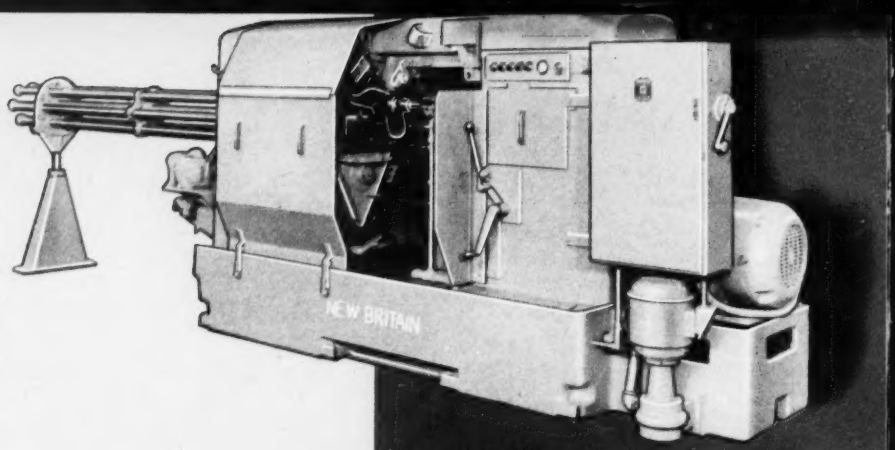
Model 126 New Britain Single Spindle Automatic was designed to cut costs on jobs which are on the border line between turret lathe and multiple spindle production. Highly competitive job shops buy it because wedge-type cross slide cams and automatic turret feed transmission enable them to change jobs in an hour or two. Production shops buy it to turn out the same part, year after year, at minimum cost per piece.



This New Britain +GF+ copying machine is a profitable producer on either long or short runs. Two actual cases: In a single year one plant made money on 700 different short run copying jobs turned out on one of these machines; another manufacturer with thirteen machines is producing a transmission part at the rate of 1,000,000 a year.

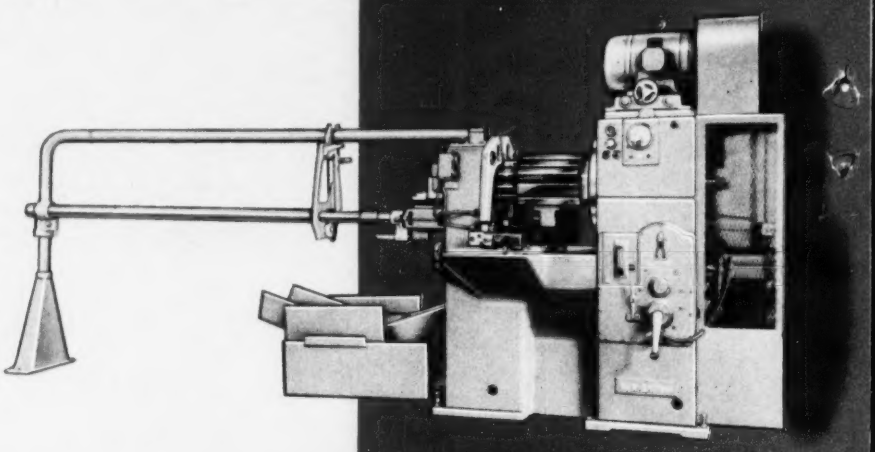
MODEL 601

Six Spindle Automatic Bar Machine, 1¼" capacity. Massive, powered for tough forming steel jobs, and with super high spindle speeds for non-ferrous metals. Cross slides in each position are actuated by small disc type cams mounted directly behind the side.



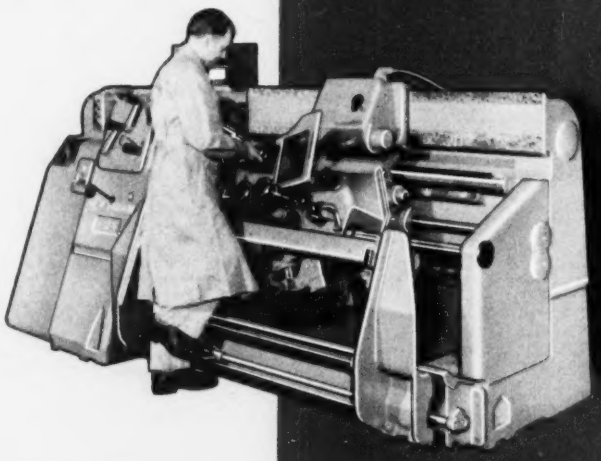
MODEL 126

Single Spindle Automatic. Capacity 2⅝" x 6". No cam changes for main turret feeds • No pick-off gears to change in selecting speeds and feeds • Quickly adjustable standard wedge cams for cross slide feeds • Automatic cycle completely controlled from central drum • Pre-selected, automatically changed feeds for each of five turret stations.



NEW BRITAIN +GF+

Copy Turning Machine eliminates the conventional lathe bed. Chips fall free and accumulate through the back of the machine. Copying carriage is mounted below the spindle. Every control is at the operator's finger tips, and template or prototype is also on the front of the machine. Self-contained pumping unit in carriage eliminates the nuisance of flexible hose. Powerful drive and a wide range of speeds and feeds make it a profitable producer on runs of any length.



Our general catalog is filed in the Sweet's Machine Tool Catalog File.

AUTOMATIC BAR and CHUCKING MACHINES • PRECISION BORING MACHINES
LUCAS HORIZONTAL BORING, DRILLING and MILLING MACHINES
NEW BRITAIN +GF+ COPYING LATHES

The NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division, New Britain, Connecticut









Are Weld Rejections Cutting Your Profits?

Here's How You Can Reduce Rejection Rates in Your Inert Gas Shielded Arc Welding Operations

Every time a welded assembly is rejected because of weld contamination, an unnecessary bite is taken out of your profits. You can reduce these rejection losses to a minimum by specifying 99.99% pure LINDE argon. High purity argon is your insurance that your welds will be free from contamination and porosity resulting in fewer rejects and higher profits.

But there's more to the LINDE story. You can be sure of your gas supply when you order LINDE argon. LINDE's many strategically located plants and distribution facilities can be counted upon to provide all the high purity argon you need even when unexpected production peaks exceed normal demands. In addition, you can call upon LINDE's Engineering Service to help you solve tough production problems when time means money.

Call your nearest LINDE office today for more information about how LINDE argon plus LINDE Engineering Service can mean increased production and greater profits for you.

Linde Air Products Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities
In Canada: DOMINION OXYGEN COMPANY
Division of Union Carbide Canada Limited, Toronto

Linde
Trade-Mark

The term "Linde" is a registered trade-mark of Union Carbide and Carbon Corporation.

For more information on products advertised, use Inquiry Card, page 241



Fisherman's Wharf — FPG Photo

BULLARD

The Invisible Background of Industrial Progress

Modern fishing fleets are no longer dependent on the winds for motive power — they are propelled by gasoline or Diesel engines traveling far and wide with the ever-changing schools of fish enabling the modern fisherman to make larger "catches" in shorter periods of time. Many of the boats have mechanical handling for the unwieldy fishing gear, and have refrigeration units to keep their "catch" fresh for market delivery.

Furthermore, canneries and processing plants employ modern methods with mechanical handling and packing equipment to bring the packaged product to your table ocean fresh.

All of this equipment, from the boats in the fishing fleet to that in the cannery, is made possible by *Modern Machine Tools* — "The Invisible Background of Industrial Progress."

THE BULLARD COMPANY • BRIDGEPORT 2, CONNECTICUT



Bullard Vertical Chucking Grinder

Available in six sizes 30" through 74"

Designed and built to maintain exceptional dimensional accuracy and produce uniform, infinitely smooth surface finishes on the larger sizes of work, the Bullard Vertical Chucking Grinder offers you these advantages: —

Accuracy — Production grinding on large diameters to two and a half tenths of a thousandth (.00025), as determined with an electronic measuring instrument.

Versatility — Grinding and turning operations on the same machine — A selection of cutting heads in combination with grinding heads can be made when ordering.

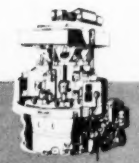
Variable speeds obtained from either of the dual control desks give required table speeds up to machine maximum.

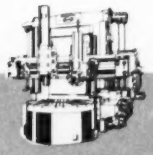
Both heads may be swiveled to meet angular requirements.

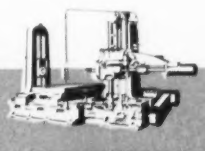
Maximum safety for the operator is provided by means of electrical interlocks so that the machine cannot be started while loading or making adjustments.

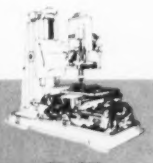
Vertical construction provides ease of loading — "It's easier to lay heavy work down than to hang it up."

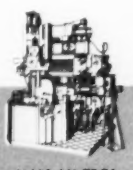
Call your Bullard Representative who will be glad to give you complete details or write to The Bullard Company, Bridgeport 2, Connecticut — phone EDison 6-2511.


CONTIN-U-MATIC


CUT MASTER


HORIZONTAL BORING


SPACER


MAN-AU-TROL


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BULLARD



POWER PLUS —

at 2000 blows a minute!

The new CP Universal Electric Impact Wrench hits a new high in power and performance. Its powerful impact action develops 2000 blows a minute to run nuts or screws . . . or tap faster and easier than any other electric wrench in its class! Designed with a narrow 2" diameter nose for getting into real tight spots, the CP-903R is rated at $\frac{3}{8}$" bolt size capacity but in most cases has an extra bonus capacity rating of $\frac{5}{8}$".

Simple, one-hand operation is afforded by its exactly centered pistol grip and reverse switch in the handle. And the reverse switch interlock prevents reversing while wrench is running. Other important features are its "unitized" motor, which assures long, maintenance-free service life plus resistance against vibration. For more information, write, *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

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Fig. 1

producing this pulley assembly shows off the versatility of Hydroforming



Fig. 2

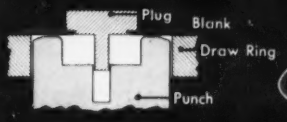


Fig. 3



Fig. 4



Fig. 5

In addition to drawing simple or intricate shapes, the Cincinnati Hydroform accomplishes simultaneously what are considered conventional *die set* operations. This is illustrated by the ingenious method used to produce the forming operations for the experimental short run pulley assembly shown in Fig. 1.

The pulley flange section (Fig. 2) was Hydroformed complete in *one* operation from a flat, 8″ dia. blank of 0.062″ cold rolled steel having a 2½″ dia. center hole. The walled hole was produced at the same time as the balance of the part by use of a piloted plug which formed the material into a recess in the punch. (See Fig. 3.)

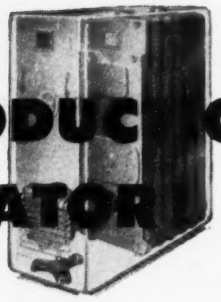
The hub flange section (Fig. 4) was produced in *two* operations. The hub was first drawn using conventional Hydroform tools—a punch and draw ring. In the second operation, a ring was used to form the balance of the part. (See Fig. 5.) This combined a forming and a restriking operation which produced the required dimensional accuracy, including the sharp 0.060″ compound radii on the flange.

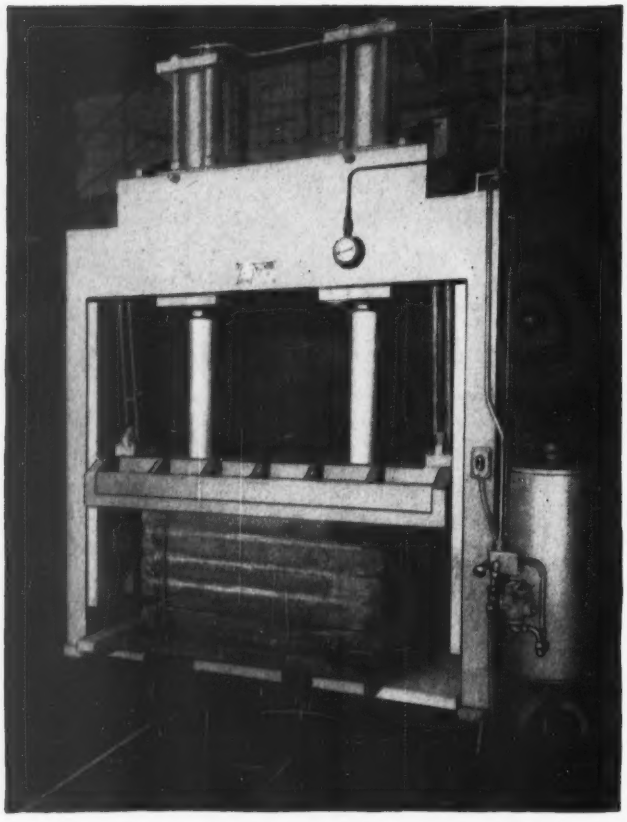
Thus the Hydroform can often be tooled inexpensively to do *more* than deep drawing and forming, saving operations which *further reduce* the cost of your development work . . . or your short run parts production. Let a Cincinnati Milling field engineer give you complete details. General Hydroform data and specifications of the 8″, 12″, 19″, 23″, 26″ and 32″ machine sizes are given in Bulletin M-1759-2. Write for your copy.

CINCINNATI **Hydroform**

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U.S.A.

KRW PRESS UPS PRODUCTION 20% AT DUNKIRK RADIATOR





THIS KRW 2-cylinder, motor-driven Hydraulic Press has increased production about one-fifth at Dunkirk Radiator Corp. It's used for pressing together 160 lb. cast iron boiler sections. The sections are cemented together, nippled, then pressed and tied with tie rods.

PLATEN SPEEDS PRODUCTION

Dunkirk officials tell us that this platen-type press is far superior to the press they were using. The platen is much steadier, can be slowly "inched" down to the work — but doesn't have to be guided. The press is accurate and rapid and the movement of the platen during the Press operation is much more stable.

ANY PRESSING PROBLEMS?

KRW has the right Hydraulic Press for you. We make a complete line; one, two and three cylinder models — all self-contained above ground; 25-150 ton capacities; hand, air or motor driven. Check your Machinery dealer or get in touch with us at Arcade, N. Y.

ONLY KRW GIVES YOU ALL THESE FEATURES:

- **Heavy Construction Throughout.** Bed and Crown Members Truss Reinforced for Added Stiffness and Strength. A KRW Exclusive Feature.
- **Any Tonnage Pressure** up to Rated Capacity can be Obtained Quickly and Selected Pressure Locked for Repetitive Operations.
- **One Swinging Ball Arm** Controls Motion of Ram Downward, Holds Pressure on Work, or Returns Ram.
- **Excellent "Inching" of Ram** Because Motor Runs Only When Operator Moves Ball Arm for Downward Ram Travel.
- **Spring Return of Ram** Gives Maximum Speed on Up-Stroke.
- **Highest Quality** Radial Type Hydraulic Pump.
- **Direct Connected Motor Drive** Through Flexible Coupling.
- **Two Speed Hand Pump** also Furnished on Motor Driven Presses in this series.

K·R·WILSON

213 Mill Street, Arcade, N. Y.



Designers and Builders of the Right Hydraulic Press to Solve Your Metal-working Problems!

For more information on products advertised, use Inquiry Card, page 241



with TOCCO* Induction Welding

Here's the story of how one company, a large manufacturer of automotive equipment and farm implements, is using TOCCO Induction Heating to increase production and effect substantial savings at the same time.

Production Increased

When TOCCO Induction Heating replaced oxy-acetylene, output of these hollow "track roller shafts" went up from 220 to 300 pieces per 8 hour shift. The heating cycle with TOCCO is only 55 seconds as opposed to 90 seconds formerly required with gas. Result: much lower labor cost per unit.

Fuel Savings

Fuel costs nosedived from $10.50 per hundred pieces to only $1.95—about $25 per shift saved on fuel costs alone. Other important savings have resulted from a substantial reduction in down time and maintenance costs. Quality of the weld is more uniform with Induction, and hazards of explosion present with former method are eliminated.

If the manufacture of your product involves welding, heat treating, forging, brazing or the melting of ferrous or non-ferrous metals, don't overlook TOCCO as a sound method of increasing production, improving product quality and slashing costs.

THE OHIO CRANKSHAFT COMPANY



TOCCO

*Trade Mark Reg. U. S. Pat. Off.

Mail Coupon Today

FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-8, Cleveland 1, Ohio

Please send copy of "TOCCO Induction Heating."

Name_____

Position_____

Company_____

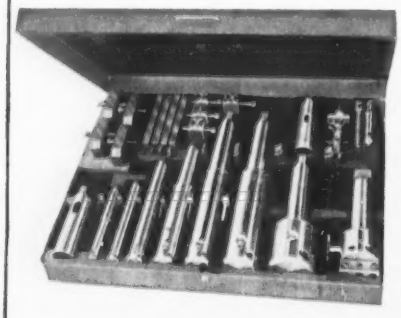
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City_____ Zone___ State_____



Davis "Super Micrometer" stub boring tool sets give you greater machine use by eliminating cut-and-try boring. They are extremely rugged, adjustable to .0001 in.

With these handy, production-boosting tool sets you have high precision tools for handling heavy boring assignments from ⅜ to 7 in. diameter . . . light, extended boring up to 13 in. diameter.



Set No. 11 (illustrated) contains seven stub boring tools covering a boring range from 1½ to 7 in. It is one of the ten complete, convenient, standard sets for you to choose from.

Modifications in any set can be made to meet your exact requirements.

Available for almost immediate delivery, these sets are all equipped with high-speed steel cutters. Stellite, super-high-speed steel or tungsten-carbide tipped cutters can be furnished upon request. Some sets include offset boring heads, pencil boring heads and reducing sleeves . . . plus setup items such as parallels, adjustable stop jacks and T-slot parallel blocks.

See your representative or write for details.

If Davis can't bore it — it can't be done

Davis Boring Tool Division

GIDDINGS & LEWIS MACHINE TOOL COMPANY

FOND DU LAC, WISCONSIN

Builders of plain and micrometer adjustable block type boring tools; line boring bars; special boring tools; car boring tools; planer, vertical boring and turning mill tools; Quick Change arbors and sleeves.

For more information on products advertised, use Inquiry Card, page 241

For HYDRAULIC presses, too . . .
it pays to specify BLISS



At Willys Motors, Inc. Wilson Foundry Division
Pontiac, Michigan

9 BLISS HYDRO-DYNAMIC PRESSES give fast, versatile production of 90 mm. cartridge cases

Wilson relies on a battery of nine Bliss Hydro-Dyamic presses to keep 90 mm. cartridge case production rolling. In all pre-cupping, drawing, pre-heading, heading and tapering operations, their range of 100- to 2500-ton Bliss presses has proved fast, versatile and easy to work with.

And that's true not only in armaments, but in the aeronautical, automotive and other industries as well: more and more firms find that the Bliss Hydro-Dynamic presses offer the speed, versatility and accuracy they need. For complete information about the many standard and special-purpose Hydro-Dyanamic presses, write or wire for copies of our 36-page Catalog 30-A.

BLISS on your press is more than a name . . . it's a *guarantee*

E. W. BLISS COMPANY, Canton, Ohio

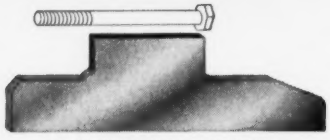
PRESSES, ROLLING MILLS, SPECIAL MACHINERY

Subsidiary: The Die Supply Company, Cleveland, O. • E. W. Bliss (England) Ltd., Derby • E. W. Bliss Company (Paris) France

U. S. Plants in Canton, Salem and Toledo, Ohio; Hastings, Michigan; and San Jose, Calif. *Branch Offices* in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, Toledo; and Toronto, Canada. *West Coast Representatives:* Moore Machinery Co., Los Angeles and San Francisco; Star Machinery Company, Seattle. *Other representatives throughout the world.*

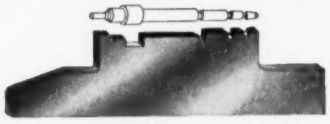


Talide Blades Any Size—Any Shape



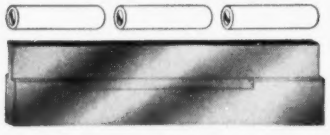
LEADING BOLT MAKER

PART.....Hardened Alloy Steel Stripper Bolt.
OPERATION....Grind O.D. of bolt body.
MACHINE.....No. 2 Cincinnati Centerless Grinder.
BLADE.....Standard Talide-tipped Infeed work support blade No. 223877.
RESULTS.....Talide-tipped blade gave 1600 hours of continuous service compared with normal production of 20 hours obtained with high-speed steel blade.



LARGE ELECTRIC MOTOR PLANT

PART.....Stainless Steel Rotor Shaft for Electric Motor.
OPERATION....Grind 7 diameters simultaneously.
MACHINE.....No. 2 Cincinnati Centerless Grinder.
BLADE.....Special multiple step Talide-tipped work support blade No. C-4884.
RESULTS.....Talide-tipped blade in continuous production for 91 days (2 turns per day) compared to best previous production run of 3 days with hard alloy steel blade.



LARGE MID-WEST BUSHING PRODUCER

PART.....Cast Bronze Bushing.
OPERATION.....Grind O.D. of bushing body.
MACHINE.....No. 12 Landis Centerless Grinder.
BLADE.....Standard Talide-tipped thru-feed work support Blade No. CA-32328.
RESULTS.....Talide-tipped blade maintained size without scoring or scratching while grinding 1,000,000 hard bronze bushings—previous Stellite blade wore out after grinding only 40,000.



One-piece Talide strip (up to 100" without seams) prevents scoring and scratching. Write for new 84-page Catalog 54-G or ask for sales engineer to call. Metal Carbides Corporation, Youngstown 7, Ohio.

METAL CARBIDES CORPORATION
MC
TALIDE
YOUNGSTOWN 7, OHIO

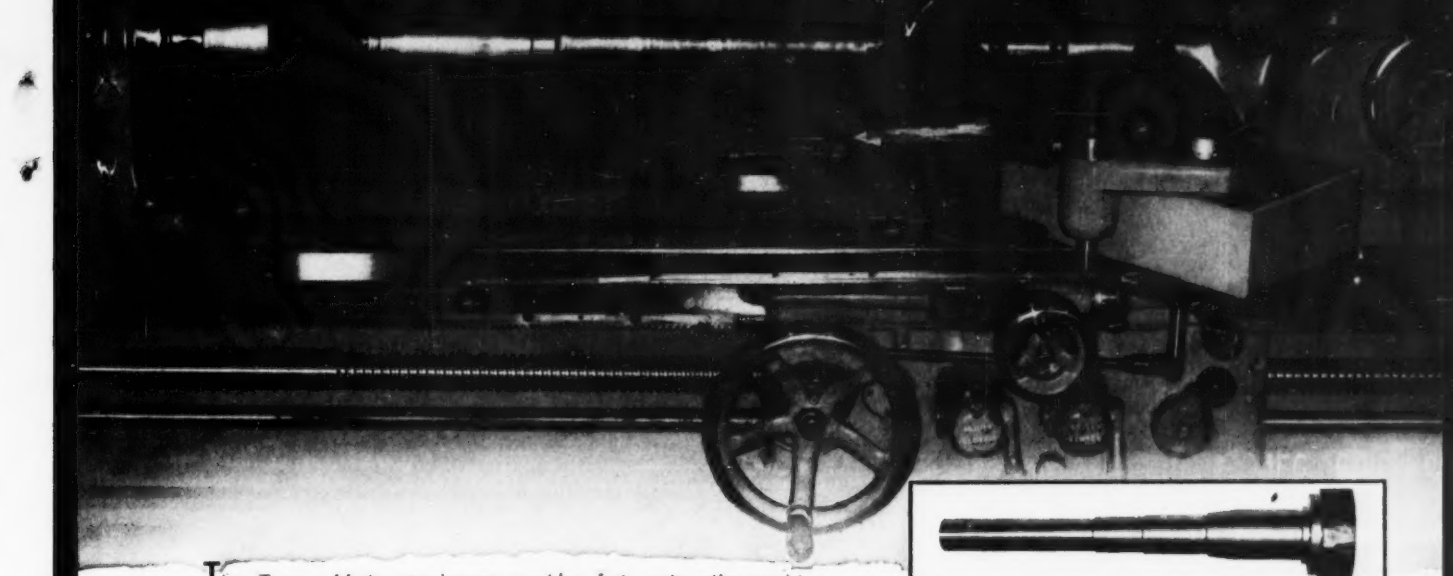
SINTERED CARBIDES · HOT PRESSED CARBIDES
HEAVY METAL · CERMETS · HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

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forged spindles are now turned

200% faster

with the new Axelson Trace-o-Matic Hydraulic Tracer Attachment

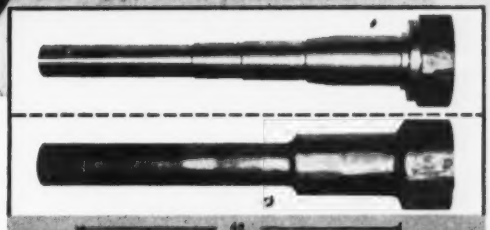


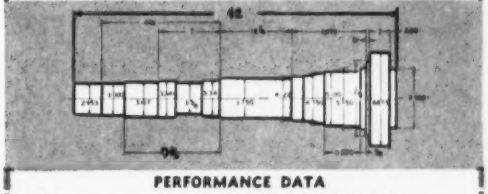
The Trace-o-Matic attachment provides fast, automatic precision duplication from flat templates and is adaptable to all classes of work including contour turning, boring and facing. It takes full advantage of the ability of Axelson lathes to take heavy uninterrupted roughing cuts or fine finishing cuts to very close tolerances without the need of a highly skilled operator.

Many outstanding features are designed into the Trace-o-Matic which make it exceptionally economical to own and to operate. Only simple, inexpensive flat soft steel templates which serve for both roughing and finishing are required. Templates can be readily made in your own shop by turning in a bar holder or any other method. In addition, only simple single point tools are required and expensive form tools are completely eliminated. Set-ups require only minutes and after the machine is set to turn the first work diameter it is automatically set to produce all diameters and contours from the template. Small lots or large quantity production work can be handled with equal efficiency and economy.

Your turning costs can be greatly reduced and your production increased by installing a Trace-o-Matic on your present Axelson lathe or by ordering it on a new Axelson lathe. It will pay you to look into the matter without delay!

Write for Axelson's 16-page bulletin describing the New Axelson Trace-o-Matic attachment in detail, or call your nearby Axelson distributor. 6156 Boyle Street, Los Angeles 58, California





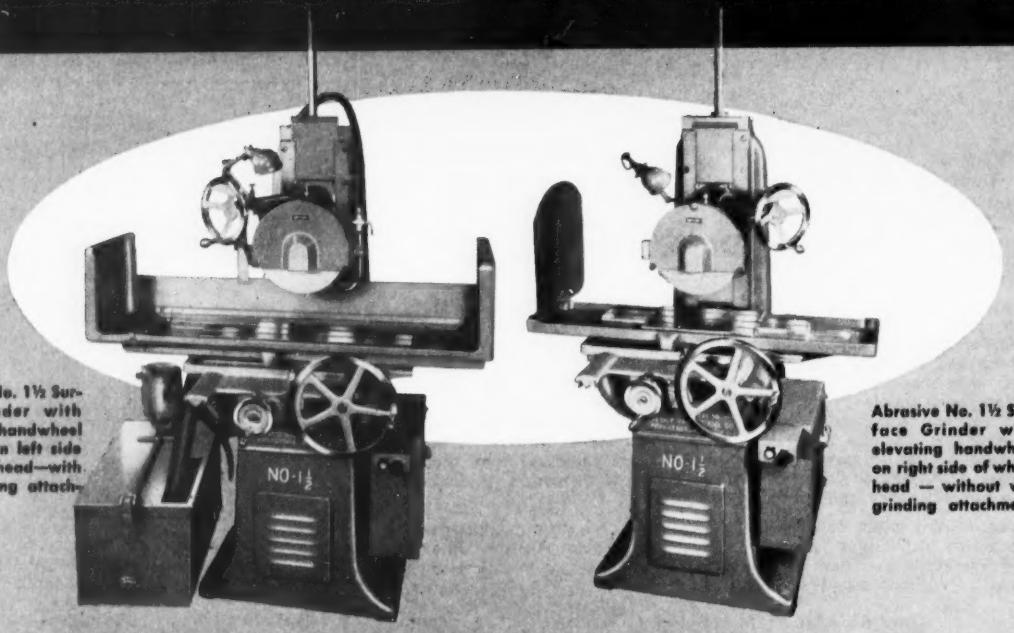
PERFORMANCE DATA

Part	MACHINE SPINDLE
Machine	Axelson 20" lathe with Trace-o-Matic attachment
Number of Pieces	6
Material	4820 Steel Forging
Hardness	180 Brinnell
Max. Depth of Cut	¾"
Greatest Precision	+.003"—.000"
Tool Material	Tungsten Carbide
Floor to Floor Time	64 Min. with Trace-o-Matic
Floor to Floor Time	129 Min. Former Method
Production Increase	200%



AXELSON MANUFACTURING COMPANY DIVISION
PRESSED STEEL CAR COMPANY, INC.
LOS ANGELES 58, CALIFORNIA

ABRASIVE NO. 1½ GIVES YOU

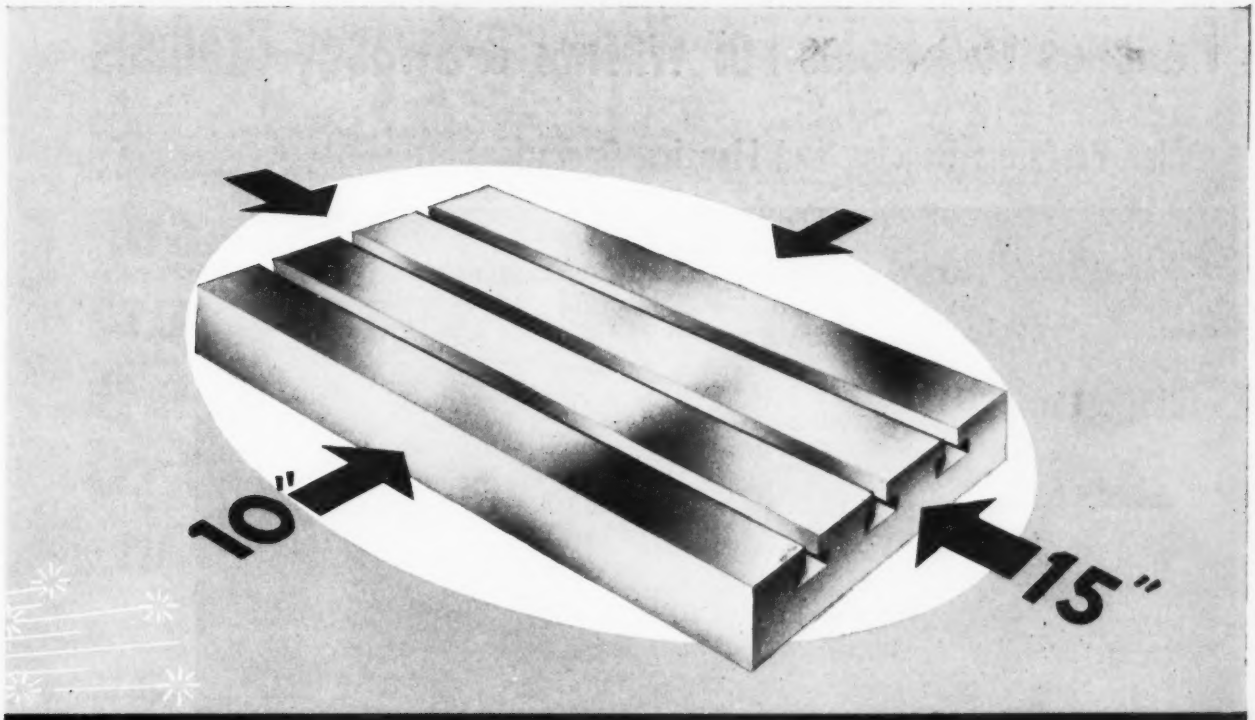


Abrasive No. 1½ Surface Grinder with elevating handwheel mounted on left side of wheel head—with wet grinding attachment.

Abrasive No. 1½ Surface Grinder with elevating handwheel on right side of wheel head — without wet grinding attachment.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

Abrasive Quality is Re



150 SQ. IN. OF WORK SURFACE

No other toolroom surface grinder equals the Abrasive No. 1½ for capacity. This precision-built grinder gives you nearly 50% more work surface area than any comparable hand feed grinder.

The big, open table with the T-slots ground in place helps your toolmakers get work out faster and easier. The unobstructed work area cuts set-up time on every job. Other features that make the No. 1½ a toolroom favorite are its smooth-working, convenient handwheels; its precise crossfeed adjustment; its ability to produce fine surface finishes and to hold size and flatness within close tolerances.

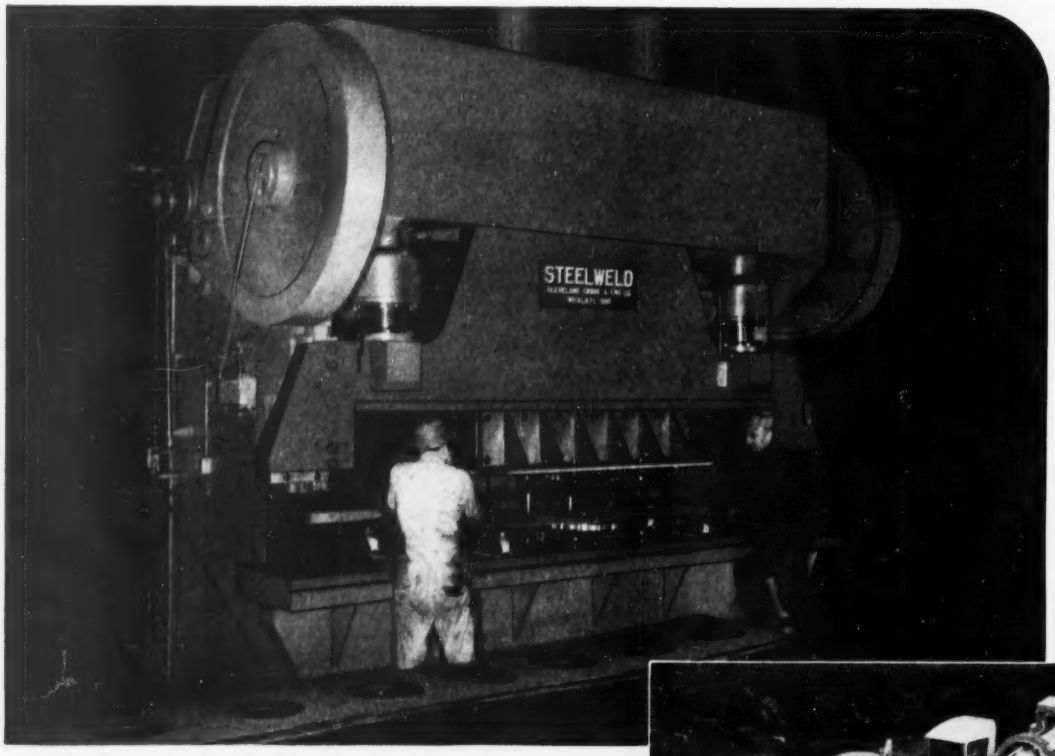
Find out for yourself why so many thousands of these simple, efficient grinders are in service today — in tool and die shops, and in tool departments of production plants. Send for Abrasive No. 1½ Catalog giving complete details. Abrasive Machine Tool Company, 12 Dunellen Road, East Providence 14, R. I.

flected in the Finish of Your Product

Punches 15" Holes For Warner & Swasey Gradalls

Also Performs Bending and Flanging Operations

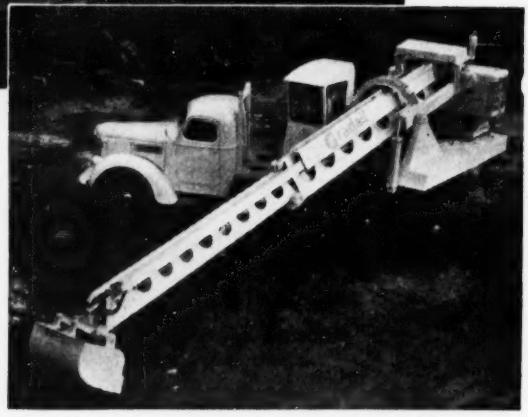
Flanging 15" diameter holes in outer boom plates of 3/16" steel. The holes were punched previously on this press.



Practically all of the steel plate on Warner & Swasey Gradalls, manufactured at their New Philadelphia, Ohio plant, is formed, punched and flanged on a Steelweld Press which is designed to brake steel plate up to 16' x ½".

One of the more interesting jobs done on this machine is the punching of 15" diameter holes in Gradall boom plates, followed by a flanging operation. Through use of special movable punches, many smaller holes of various sizes are made at a time, in locations as desired.

The versatility of Steelweld Presses to handle efficiently many varied operations has proven of tremendous advantage to many users. You, too, may find the many features of these machines of great help. A representative will be glad to give you the details.



Gradall ready for action. Has ½ yd. bucket and 24 ft. telescoping boom that lifts, tilts, and turns 360° around truck.



GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

5442 EAST 281 ST., WICKLIFFE, OHIO

STEELWELD

BENDING PRESSES

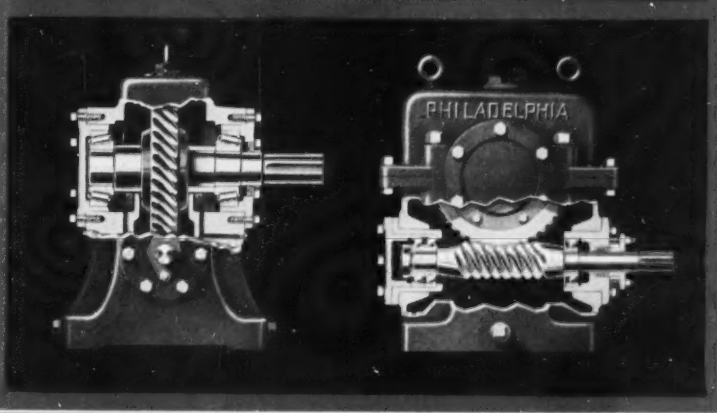
BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

For more information on products advertised, use Inquiry Card, page 241

PRECISION-BUILT

RUGGED
STURDY
EFFICIENT
LOW UPKEEP
LONG LIFE





Why do we say Precision-Built?

Because . . . just as much research, design and engineering have gone into the making of these Heavy Duty Worm Gear Reducers as that of the finest time piece.

Material and manufacturing standards are very rigidly maintained in producing Philadelphia Worm Gear Reducers with the result that long and efficient life is effectively built into these units.

Worms are of alloy steel with carburized hardened and tempered threads, both shaft and threads are smoothly ground and polished after heat-treating.

Worm Gears are made from the highest quality chilled-cast nickel bronze.

Bearings are anti-friction types (ball or roller) insuring smooth, quiet, long-lived performance.

Housings are oil-tight quality grey iron . . . designed to assure maximum *rigidity* and heat radiation, with ample oil reservoir.

Units are available with Worms *above* or *below* the Worm Gear; also with shafts up or down for Vertical Drives.

A complete range of sizes are available to cover any application up to 265 H.P., with ratios from 3⅜:1, to 6300:1. They are built to provide *efficient* and *dependable* power transmission under the most *rigorous* conditions over a long period of time, at very *low maintenance cost*.

For further detailed information write for latest catalog WG-51.

Philadelphia Gear Works, INC.



ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

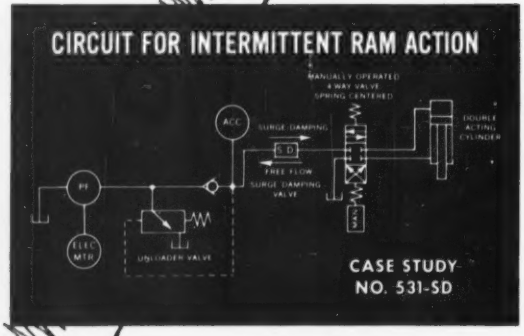
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

Protects hydraulic circuits



ACTUAL SIZE



Denison Surge Damping Valve prevents hydraulic shock... eliminates damage to fittings, lines, seals and equipment

Sudden starting, sudden release of high pressure into a low pressure area, or reversal of flow causes a hydraulic surge as damaging to a circuit as blows from a hammer.

The Denison Surge Damping Valve converts the hydraulic surge into a smooth, gradually accelerated flow of fluid power. A hydraulically unbalanced reaction flow control in the valve causes the valve to open slower as the intensity of the surge increases.

Lightweight and easy to install, the Denison Surge Valve can be used on any circuit up to 5000 psi. Requires no adjustment . . . interferes in no way with the efficiency of the circuit.

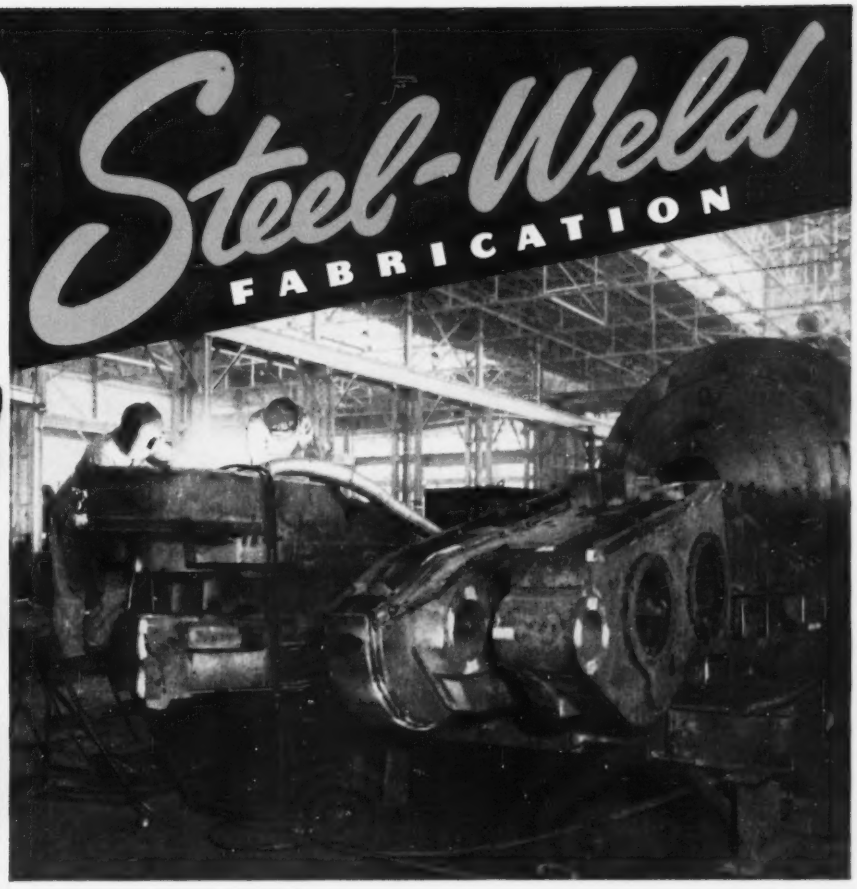
The circuit shows a Denison Surge Damping Valve preventing hydraulic shock when stored-up energy in an accumulator is released. For a bulletin on the surge valve, write to: THE DENISON ENGINEERING COMPANY, 1152 Dublin Road, Columbus 16, Ohio.

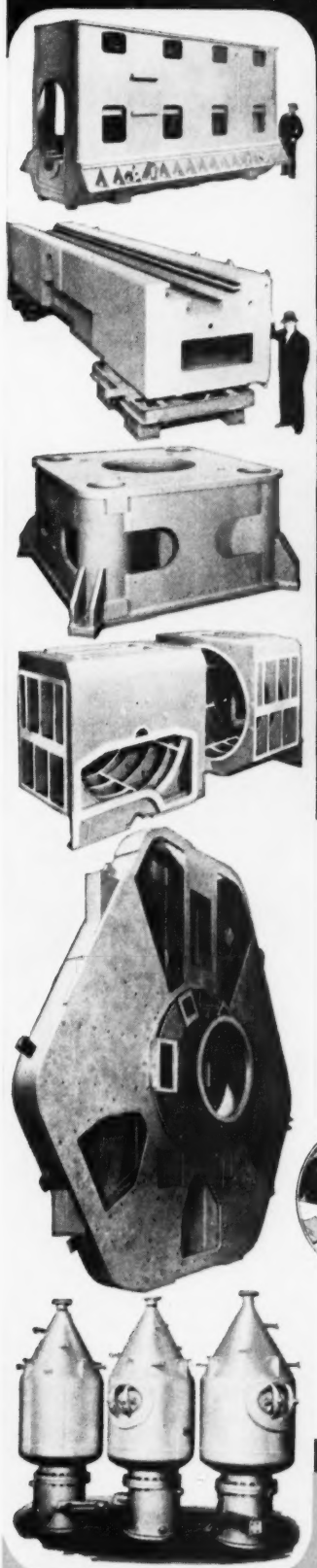
PUMPS • CONTROLS
MOTORS • PRESSES

DENISON
TRADE MARK
Hydr OIL ics

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Steel-Weld FABRICATION





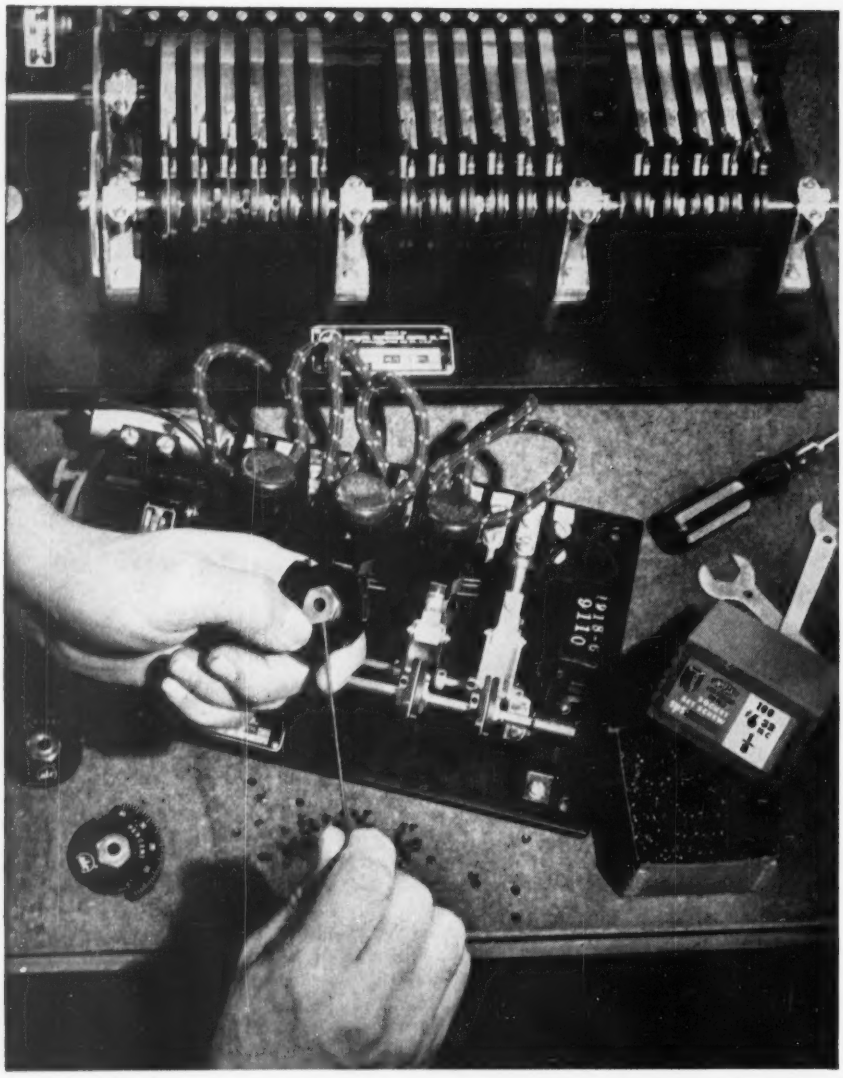
Use WELDED STEEL for Greater Strength with Less Weight!

The Crawler Side Frames illustrated above, parts of a large strip mining machine which were formerly produced in casting form, were redesigned and produced by Mahon as weldments. These and the parts and assemblies shown at the left are typical of thousands of Steel-Weld Fabricated units produced and machined by Mahon for hundreds of manufacturers of processing machinery, machine tools and other types of heavy mechanical equipment. If you require welded steel parts, assemblies, or special purpose equipment, you can turn to Mahon with complete confidence . . . highly skilled personnel are available within the Mahon organization to do the complete job from drawing board to finished machining and assembly—thoroughly experienced personnel who are backed by tools and plant facilities with capacity to produce virtually anything in welded steel construction regardless of size or weight. You will find in the Mahon organization a unique source for Steel-Weld Fabrication . . . a source where skillful designing, advanced fabricating techniques and superior craftsmanship assures you a smoother, finer appearing job embodying every advantage of Steel-Weld Fabrication. See Mahon's Insert in Sweet's Product Design File, or have a Mahon engineer call and give you complete information.

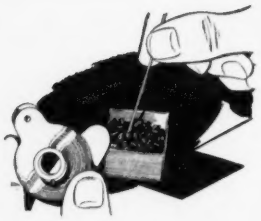
THE R. C. MAHON COMPANY
DETROIT 34, MICHIGAN

Engineers and Fabricators of Steel in Any Form for Any Purpose

MAHON



Two UNBRAKO Self-Locking Socket Set Screws are used on each cam of these precision multicircuit cam timers. The screws position the cams so as to control accurately the sequence and duration of one or a series of individually timed machine or process operations.



Assembler picks up tiny UNBRAKO set screw with long arm key preparatory to threading it into cam assembly.



He inserts the UNBRAKO, and turns it into the assembly; then after positioning cam, tightens it. The accurate depth and size of the hex socket result in maximum torquing—the knurled cup point holds the cam accurately in place.

You'll need less space for storage when you use UNBRAKO Standards—stocked by your distributor

You'll need less space for storage and be able to carry a smaller inventory, because standard UNBRAKO socket screw products are in stock at your local industrial distributor's. And you'll save time and money, because deliveries are prompt. For more information, write for UNBRAKO Standards—a complete listing of socket screw products made by the world's largest manufacturer of these precision fasteners. STANDARD PRESSED STEEL Co., Jenkintown 19, Pa.



UNBRAKOS—made of heat treated alloy steel—have fully formed threads, Class 3 fit; are supplied in standard sizes from # 4 to 1".

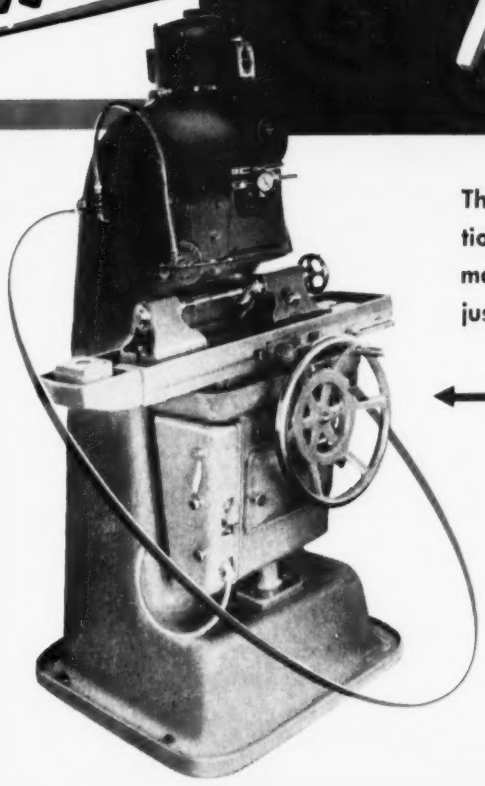
UNBRAKO SOCKET SCREW DIVISION

SPS JENKINTOWN PENNSYLVANIA



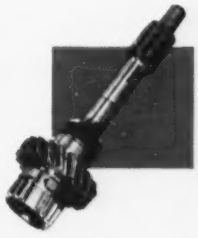
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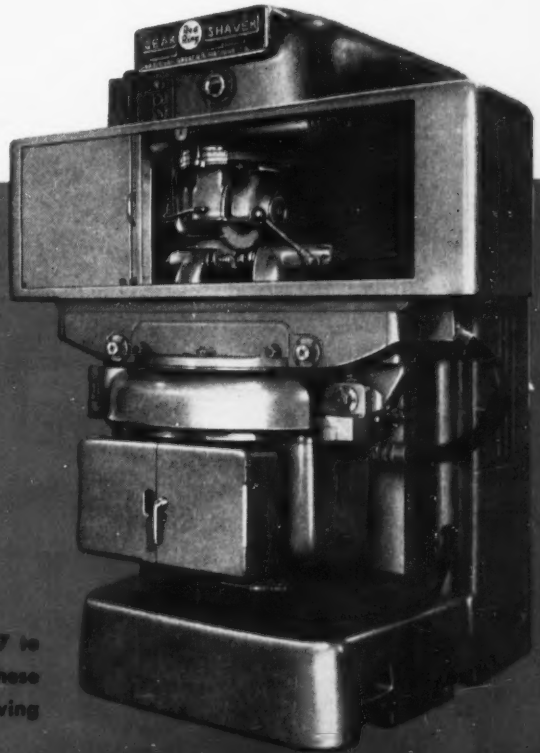
NOW IS THE TIME TO Cut Manufacturing Costs



The one sure way of meeting today's competition is with today's machine tools. The older machines were all right in their day but they just haven't got what it takes now.

← **For instance,** it took this old Red Ring Model GCC 60 seconds to shave a gear like the one shown. →

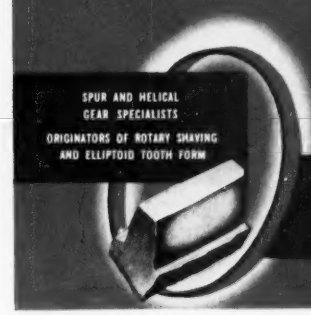




Model GCU today finishes that same gear in just 16 seconds—and to much closer tolerances, too.

In an 8 hour day the GCU will deliver 375% of the production of its predecessor.

Write for Bulletin S 53-7 **to get all the facts on these new cost saving gear shaving machines.**

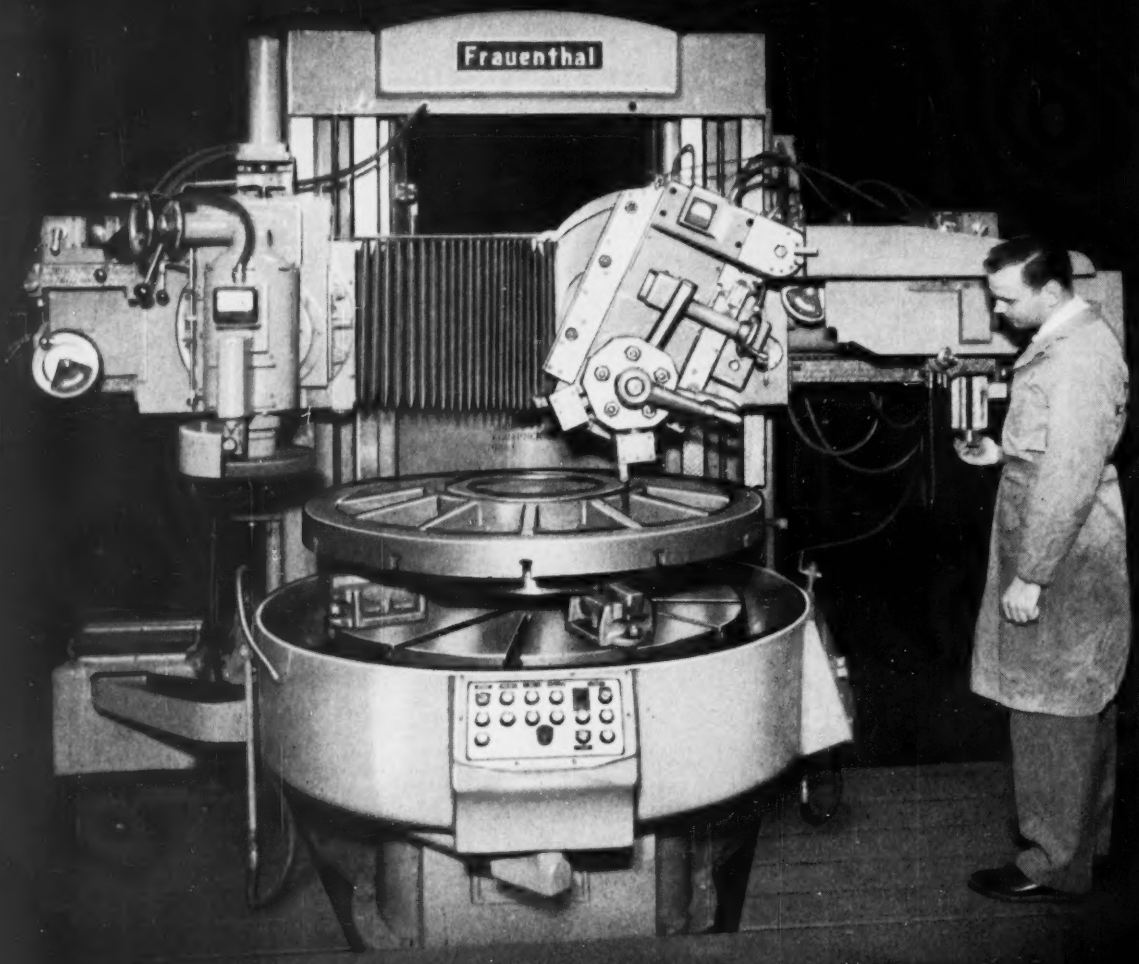


NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

announcing...



Frauenthal Division • THE KAYDON

The Frauenthal Series 3100 precision turning and grinding machine

NOW AVAILABLE FOR THE FIRST TIME — here's a machine specifically designed to perform finish turning and ultra-precision grinding operations. With it, you can produce accuracies previously considered impractical, with assured concentricity of related surfaces finished on a one-setup basis!

Originally designed to meet the exacting requirements of jet engine production, the Series 3100 machine is completely new from the ground up. Its unique design opens up new possibilities for machining large work-piece, close-tolerance jobs on a mass-production basis. The Series 3100 offers the entire metal-working industry exceptional new capacity for precision turning and precision grinding.

CHECK THESE IMPORTANT FEATURES

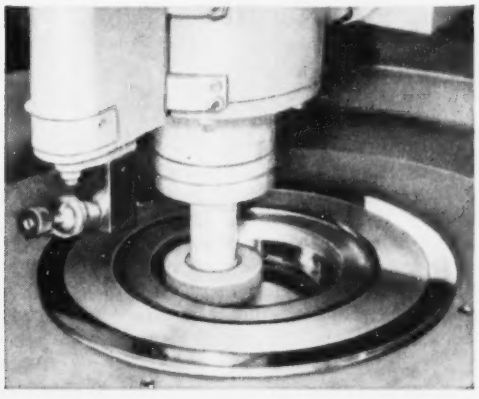
- Ultra-precision work-table bearings
- Hydraulically actuated turning slide
- Hydraulically actuated grinding slide
- Hydraulic grinding spindle
- Conveniently located controls and safety switches

. . . AND THIS OPTIONAL EQUIPMENT

- Hydraulic tracer control
- Electronic surface speed control
- Hydraulic wheel dressers for varied applications



Here, the operator uses a Series 3100 machine to bore out the inside diameter.



This closeup shows how the machine performs close-tolerance finish grinding of the workpiece's top surfaces and inside diameter.

May we help you?

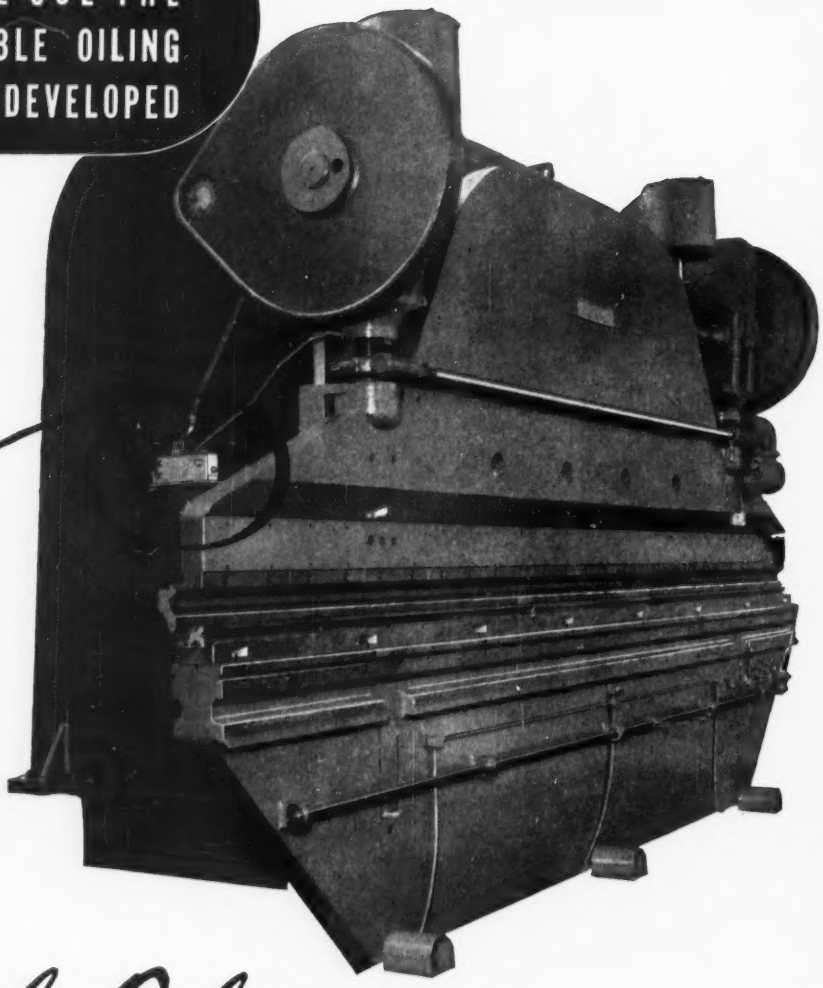
If you'd like to have details on how the Series 3100 can offer you new tool room or production benefits — our engineers are at your service. Write for informative bulletin No. 301.



Frauenthal MULTIPLE-HEAD • SUPER-PRECISION • VERTICAL **Grinders**

ENGINEERING CORP. • Muskegon, Michigan

MACHINES OF GREAT PERFORMANCE USE THE MOST DEPENDABLE OILING SYSTEM EVER DEVELOPED



Illustrated is Madison-Kipp Lubricator Model FD installed as original equipment on a 3/8" by 20' Cincinnati Press Brake, manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio.

MADISON-KIPP *fresh Oil* . . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

MADISON-KIPP CORPORATION

203 Waubesa Street, Madison 10, Wis., U.S.A.

ANCIENS ATELIERS GASQUY, 31 Rue du Marias, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

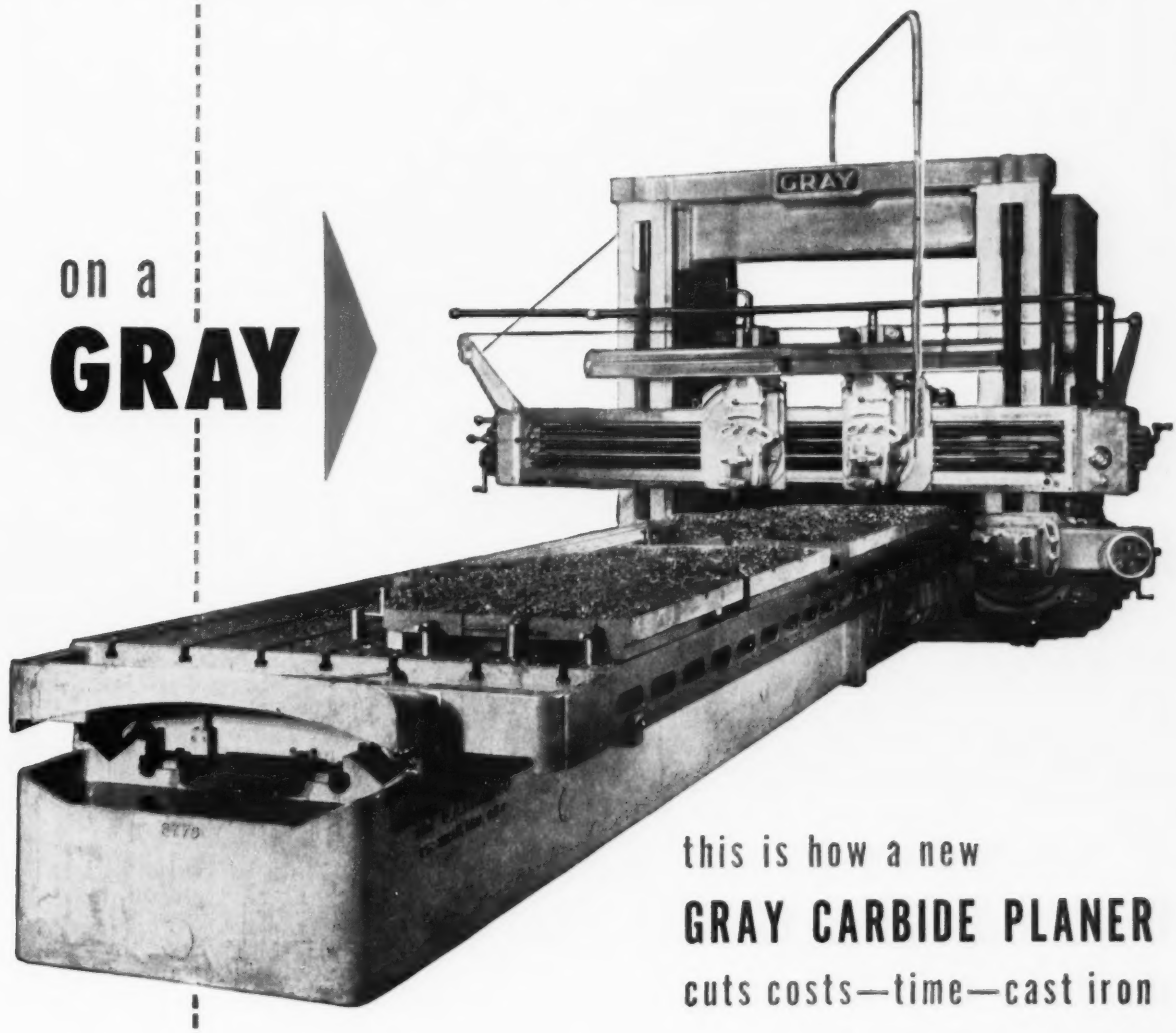
WM. COULTHARD & CO. Ltd., Carliste, England, sole agents for England, most European countries, India, Australia, and New Zealand.

- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really High Speed* AIR TOOLS

For more information on products advertised, use Inquiry Card, page 241

BIG CARBIDE PLANING PROFITS

on a
GRAY



The F. X. Hooper Co., of Glen Arm, Md. is successfully and profitably carbide planing cast iron frames on this new 84" x 60" x 18' high speed GRAY PLANER.

this is how a new
GRAY CARBIDE PLANER
cuts costs—time—cast iron

using modern carbide tools at speeds up to 300' per min. — feeds up to ⅛" and depths of cut to 1¼".

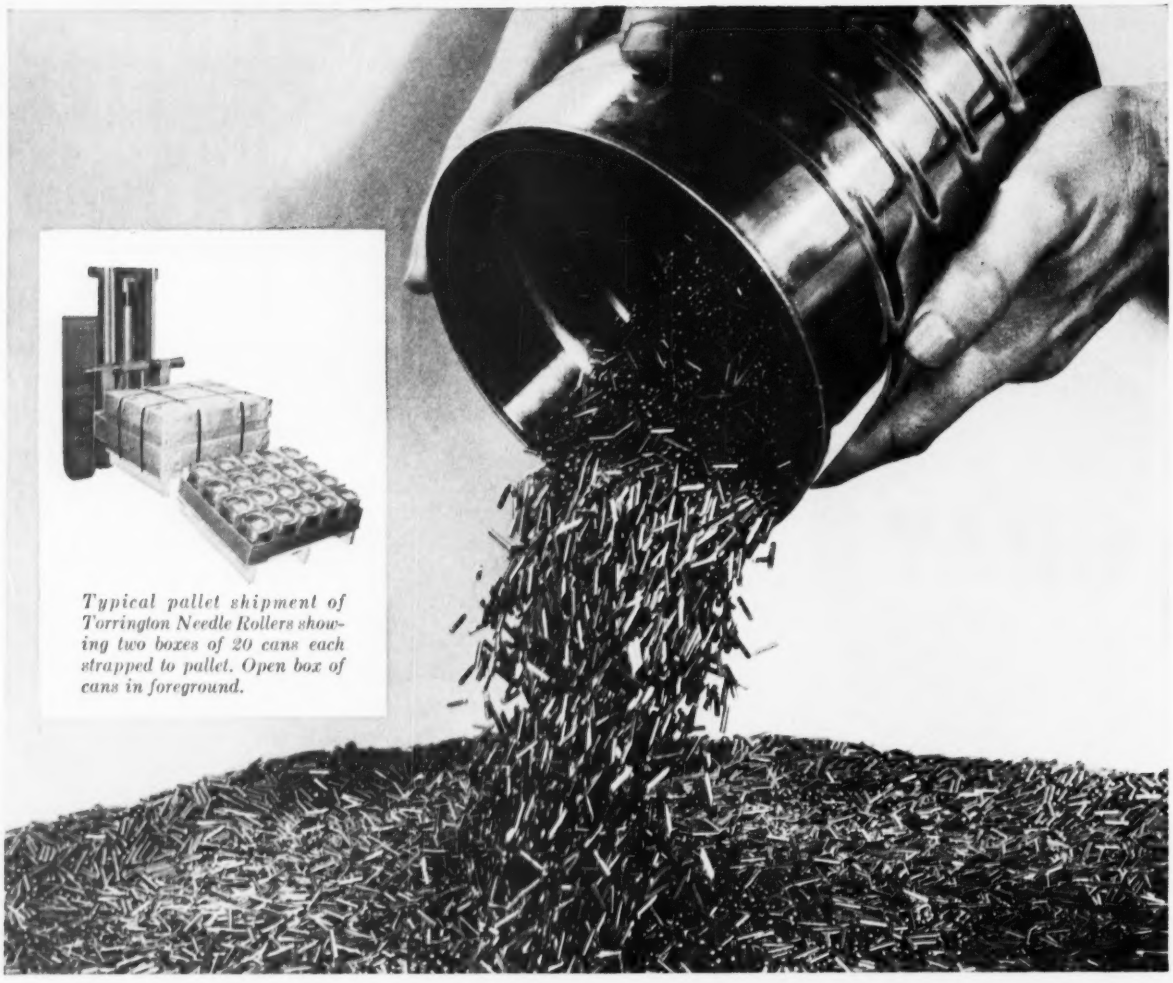
Check your planer department's time and cost figures. New GRAY performance will make your old planer *really old*.

Dept. B

The G.A. **GRAY** *Company*

planers • milling planers
planer type milling machines
horizontal boring machines

CINCINNATI 7, OHIO, U. S. A.
SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES



Typical pallet shipment of Torrington Needle Rollers showing two boxes of 20 cans each strapped to pallet. Open box of cans in foreground.

Torrington Needle Rollers—Vacuum-Packed for Cleanliness—Palletized for Easy Handling

Torrington Needle Rollers by the millions are now being vacuum-packed in tin cans to protect them from dirt, moisture and damage. The foods you eat are not packed with greater care.

This new vacuum pack permits us to send you rollers *dry*—free from oil or grease—so that they can go into your loading machines direct from the can, without time-consuming degreasing.

To make shipping and handling easier, we pack these cans 20 to a carton and strap two cartons to an expendable wooden pallet, for a total weight of about 1500 lbs. per pallet. This makes an easy load for your fork lift trucks to handle and store.

Torrington Needle Rollers deserve this special vacuum pack. They're precision rollers made under statistical quality controls of extraordinary rigor. Every step from alloy selection to polishing and packing is carefully checked to assure you that every can of rollers you receive meets your high standards. And to help you use these rollers to best advantage, Torrington's engineering staff is always available to assist in application design and testing.

Always specify Torrington for precision Needle Rollers in prime condition. In stock for immediate volume shipment.

THE TORRINGTON COMPANY

Torrington, Conn. South Bend 21, Ind.

District Offices and Distributors in Principal Cities of United States and Canada

TORRINGTON NEEDLE BEARINGS

Needle • Spherical Roller • Tapered Roller • Cylindrical Roller • Ball • Needle Rollers

For more information on products advertised, use Inquiry Card, page 241

ANACONDA METALS AT WORK

A special alloy wire goes into the G-E SLEEP-GUARD Blanket . . . sheet brass into the Westinghouse Thermometer Set . . . and Everdur Copper-Silicon Alloys into the Sherwood Valve.



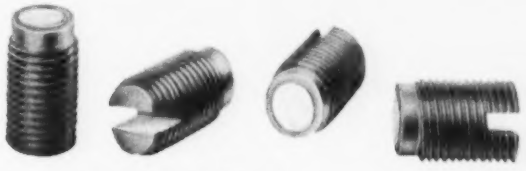
Shut-eye's safer with new shut-off control

Ahhh, sleep. . . it's wonderful! And now because of G. E.'s new SLEEP-GUARD Wiring System—made of two spiral wires separated by a nylon sheath—sleep's safer, too. If the heating wire becomes too warm, the nylon sheath—along with the heater and signal wire—automatically turns off your blanket. Both wires are made of Hitenso®, a cadmium bronze which provides just the right electrical and mechanical properties. We process almost 100 copper alloys into wire in a wide variety of sizes and shapes, tempers and finishes.



A million at one clip for Betty

Anyone who's ever settled down before a TV set needs no introduction to charming Betty Furness of Westinghouse Studio One fame. Betty's currently offering her vast viewing audience this handy Westinghouse Kitchen Thermometer Set at a bargain price. And Westinghouse expects an overwhelming response. That's why they had Chaney Mfg. Co., Springfield, Ohio, make a million of these sets at one clip. And speaking of clips, those attached to these thermometers are made of coiled brass strip in the most economical alloy, gage and temper.



Vive le valve plug!

The Aluminum and Brass Co., Lockport, N. Y., calls this valve plug—which employs a nylon insert and operates under pressures up to 3,000 psi—the "heart" of their Sherwood Oxygen Valve. We're mighty proud about their enthusiasm, since the plug is made of one of our Copper-Silicon Alloys. Everdur®-1015 was chosen because roll-threading not only frees it from burrs but also work-hardens its surface, making it less likely to wear, gall or "freeze." Everdur-1015's cold-working properties also allow it to be rolled *over* the nylon insert. A tight "cap" results.

Want more information?

Our Technical Department's wide range of experience covers virtually the entire field of copper and copper-alloy applications in industry. If you have a problem of metal selection, we are at your service. *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.*

®Reg. U. S. Pat. Off. 5486

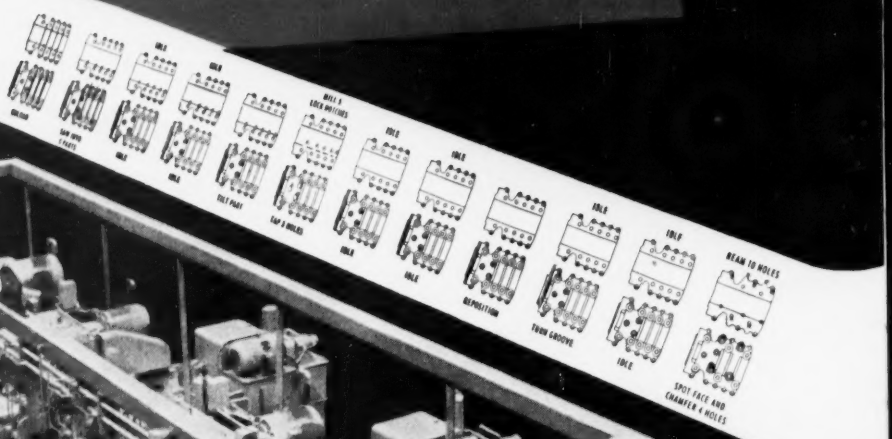
ANACONDA®

the name to remember in

COPPER · BRASS · BRONZE

NEW NATCO HOLEWAY

...Speeds production and cuts costs!



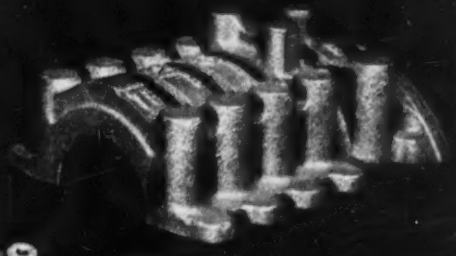
...ANOTHER MACHINE

NATCO ENGINEERED
for quality and quantity production

MACHINES 120 CRANKSHAFT BEARING CAPS PER HOUR!

...AT 85% EFFICIENCY

DRILLS, CHECKS, REAMS,
CHAMFERS, SPOT-FACES,
TAPS, MILLS, TURNS
GASKET GROOVE AND SAWS
INTO COMPONENT PARTS





This new 20 station NATCO HOLEWAY cuts costs and speeds production of crankshaft bearing caps. It drills 23 holes and checks them for depth, reams 20 holes, chamfers 13 holes, spot-faces 10 holes, taps 3 holes, mills 5 lock notches, turns gasket groove and saws 4 places to cut casting into component parts.

Above is shown a schematic drawing of the operations performed at each of the 20 stations and photographs of the parts before and after machining.

Call a Natco Field-Engineer

to help you solve your problems in
Drilling, Boring, Facing and Tapping

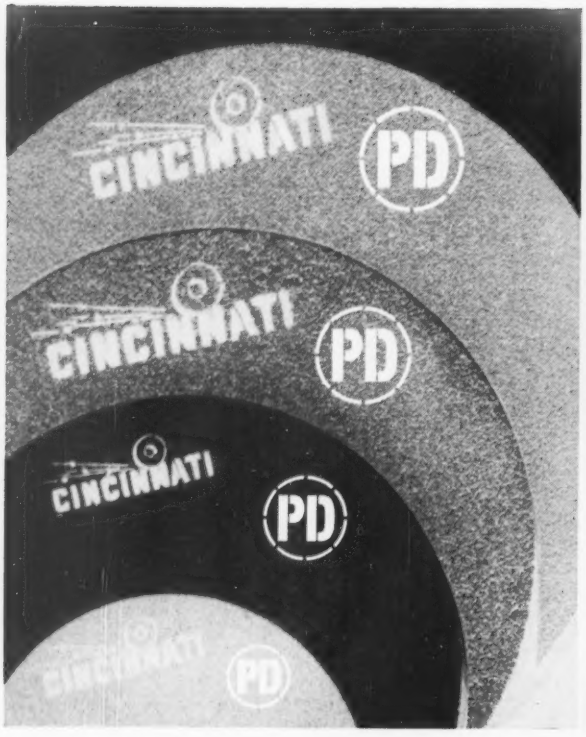
NATCO

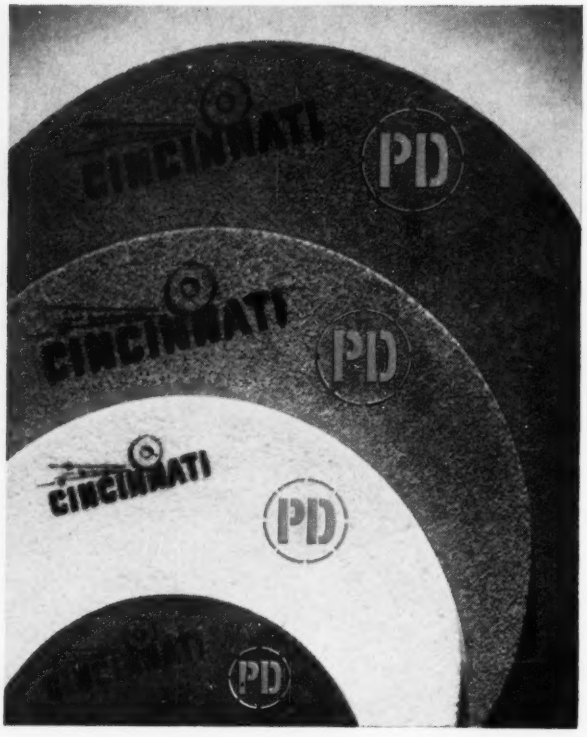
NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

Branch Offices

CHICAGO, Room 202, 6429 W. North Ave., Oak Park • DETROIT, 10138 W. McNichols Rd.
BUFFALO, 1807 Elmwood Ave. • NEW YORK, 35 Beechwood Ave., Mount Vernon

Greatest Grinding Wheel Development in Years

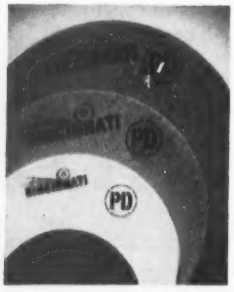




NOW!

Cincinnati Grinding Wheels offer

PD POSITIVE DUPLICATION



Without a doubt the new CINCINNATI (PD) Manufacturing Process is the most important grinding wheel development in years. It is an achievement in precision manufacturing and quality control that will save you money and increase your production. Here's why:

Through the CINCINNATI (PD) Manufacturing Process, you can be positive that every CINCINNATI (PD) Wheel you order will be produced exactly to the Cincinnati grading specified for your job.

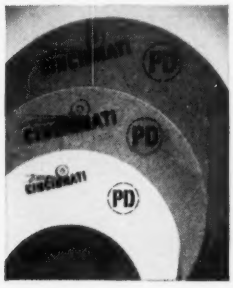
Just as a negative guarantees exact duplication of a photograph, the CINCINNATI (PD) Manufacturing Process assures a POSITIVE DUPLICATION of the original wheel EVERY time you reorder.

The problem of duplication has been a major concern of Cincinnati Milling throughout its 30 years of experience in using grinding wheels, and in supplying industry with precision grinding machines equipped with grinding wheels and ready for production opera-

tion. Cincinnati Milling found that once the right wheel had been specified for a job, it was frequently difficult to secure additional wheels of identical grading that would duplicate the performance of the first wheel. The need for positive duplication is of utmost importance not only to Cincinnati Milling, but to every user of grinding wheels.

Positive Duplication (PD) is the result of extensive manufacturing research which revealed that *several steps* in the production of grinding wheels generally considered as unimportant, were, quite to the contrary, *extremely important*.

As one step toward (PD) wheels, Cincinnati Milling constructed the world's most modern grinding wheel plant. Some of the equipment installed has never before been used by the industry in the manufacture of grinding wheels.



Then, to make (PD) wheels an actuality, Cincinnati Milling developed new standards of manufacture with 36 quality control steps. From the weighing of the grain and bonding material, through molding, drying, firing, finishing, to final inspection, every operation is carried out with the same exactness as in building a precision machine tool.

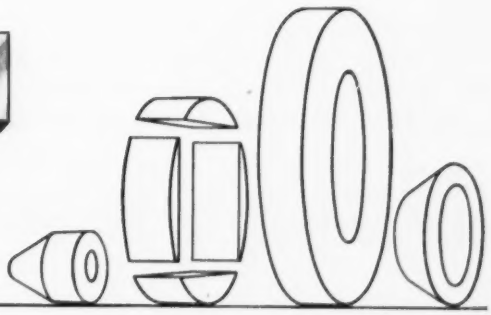
You're assured a POSITIVE DUPLICATION of the original wheel EVERY time you reorder. "On grade" with a CINCINNATI (PD) Wheel means all future (PD) wheels will act and grind exactly alike. For you, this means *no more* production interruptions which cut output and increase your costs.

Let us prove to you how CINCINNATI (PD) Wheels will make money for you. Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire, or 'phone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.



CINCINNATI (PD) Precision and Snagging Wheels are available in vitrified and resinoid bonds in a complete variety of sizes and shapes.

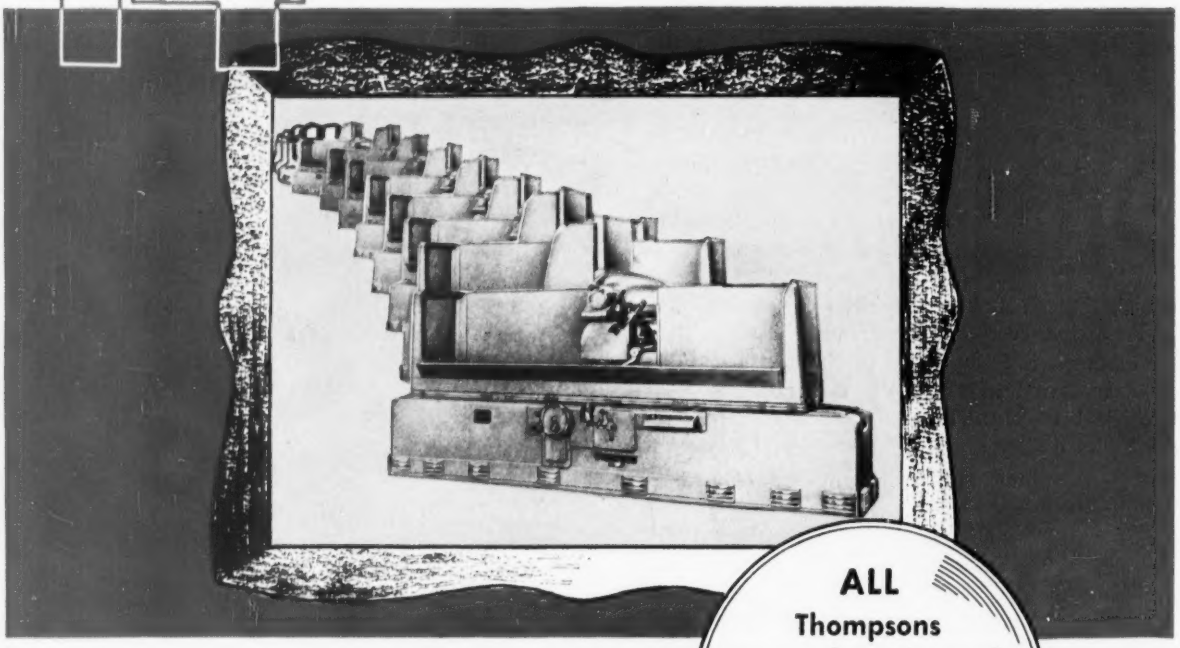
CINCINNATI
Grinding Wheels
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio



LOOK CLOSELY AT THIS PICTURE
OF GRINDER PRODUCTION AND SEE WHY...

14 is a lucky number

for a manufacturer requiring precision grinding



ALL Thompsons operated continuously with much LESS DOWNTIME

thats why

it will pay you to invest in

Thompson Grinders

After twelve years continuous manufacture of precision ground products, ten Thompson Surface Grinders proved so efficient and economical that this manufacturer ordered four more machines.

Thompson Grinders are available in a wide range of types and sizes from 6" x 18" to 72" x 384" to meet all production, special or tool room grinding requirements. The Thompson line includes machines from giant Hydrial Way Grinders to automatic Truform Jet Blade Contour Grinders, Dual Rotary Grinders and Broach Grinders.

CONTACT THOMPSON TODAY FOR HELP WITH YOUR MACHINING PROBLEMS

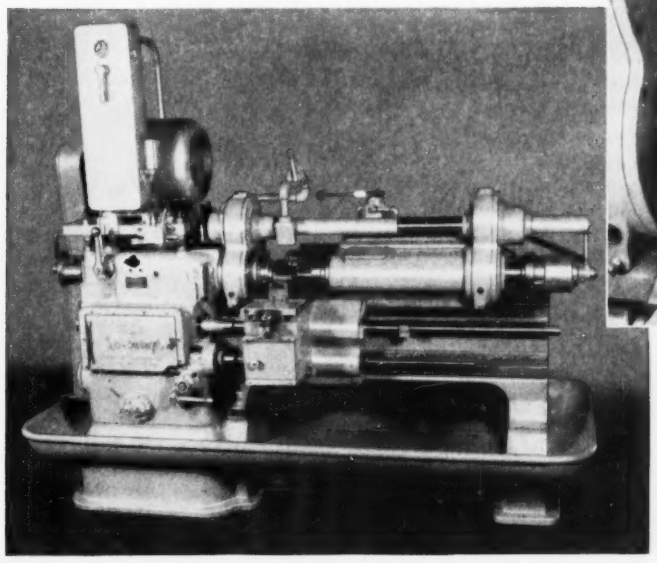
THE THOMPSON GRINDER COMPANY
Springfield, Ohio

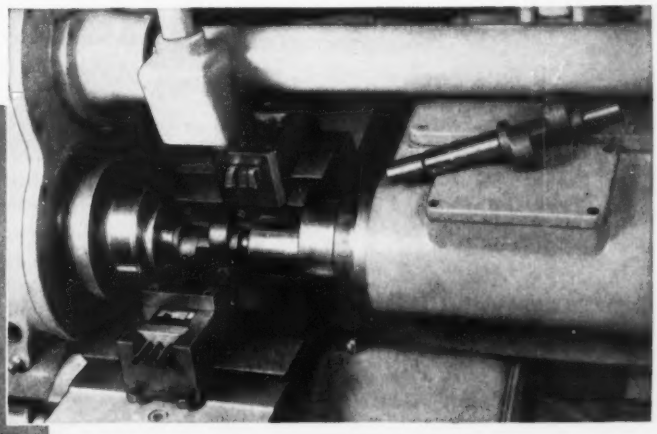
For more information on products advertised, use Inquiry Card, page 241

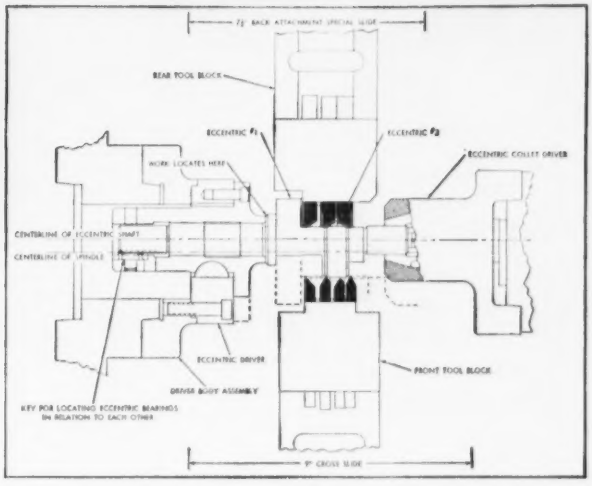
MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE *Lo-swing* PEOPLE" SENECA FALLS, NEW YORK

Model LR Lo-swing Automatic Lathe equipped with double-end drive for machining eccentrics.







DOUBLE END DRIVE *Lo-swing* LATHE MACHINES ECCENTRICS AT A FAST PACE

PROBLEM: To accurately machine eccentric bearings on compressor shafts within close tolerances.

SOLUTION: The Model LR Automatic Lo-swing Lathe selected for this operation was equipped with a double-end drive to prevent twisting or distortion of the shaft due to tool cutting pressures. The drive to the tailstock is taken from the headstock spindle and transmitted to the tailstock spindle by means of an overhead drive shaft. Special gearing eliminates all backlash.

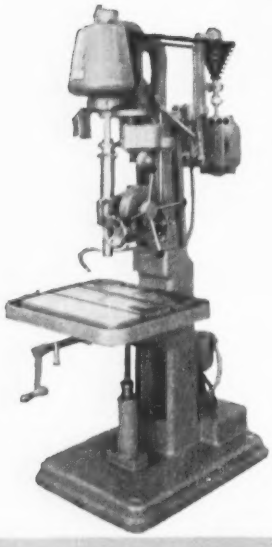
The work is held and driven with offset drivers mounted on both the headstock and tailstock spindle noses as shown in the line drawing. The drive from the headstock end is through a key which positions the shaft in relation to either No. 1 or No. 2 eccentrics. The drive from the tailstock spindle is by means of an air-operated collet driver. Loading and unloading of parts is facilitated by an air-operated tailstock which retracts 6-1/2" by a simple movement of an air control valve.

The tooling used for this job is shown on both the line drawing and the close-up view of the operating area of the machine. The front tool block has four tools for turning the eccentric and the clearance diameters adjacent to the eccentric. The back squaring attachment carries three tools, one for facing the side of No. 1 eccentric and the other two for chamfering the edges of No. 2 eccentric.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH *Lo-swing*

There is a quality



21" sliding head drills are available in box and round column models. Multiple-spindle arrangements up to 6 spindles are available. Three distinct methods of feed are incorporated as standard equipment. Three optional ranges of power feed are provided. Eight spindle speeds—76 r.p.m. to 2025 r.p.m.

16"-3000 sliding head drills are available in both floor and bench models, and with multiple-spindle arrangements up to 6 spindles. Six spindle speeds are provided.

21" Box Column Floor
$1624.00*



16"-3000 Floor
$631.00*

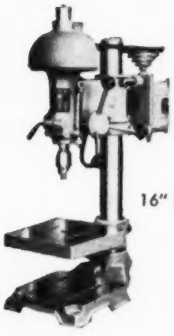
for every job and every budget

For drilling operations 1½" OD and under, Cincinnati Drills combine dependability with economy. Regardless of your drilling jobs—production, maintenance or general machine work—there is a Cincinnati Drill to fit your needs. And they are the only quality line of drills at these low, low prices.

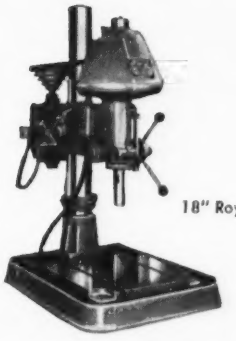
For complete information and prices, write on company letterhead for the name of your nearby Cincinnati dealer. Cincinnati Lathe & Tool Co., 3269 Disney, Cincinnati 9, Ohio.

For a clear comparison of Cincinnati Lathes with other equipment, write for a free copy of "Management Facts About Lathes".

Cincinnati Drill



16" Royal Bench
$93.00*



18" Royal Bench
$246.00*



16" Royal Floor
$103.00*

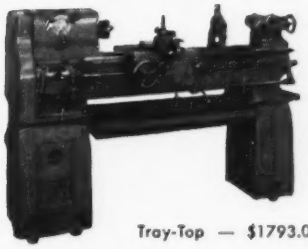
The Royal line of Cincinnati Drills includes both 16" and 18" sizes in floor, bench and multiple-spindle arrangements. They meet the demand for general purpose, sensitive drills capable of production work at a minimum investment.

*Less motor and controls.
†10" x 24" std. drive. Includes motor and controls.
‡16" x 30". Includes motor and controls.
All machines F.O.B. factory.
All prices subject to change without notice.

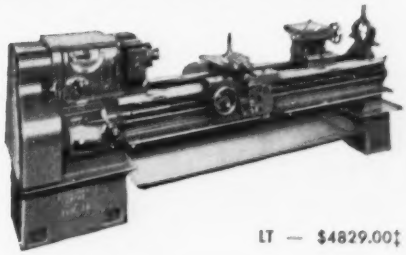
center on...

cincinnati lathes and drills

THERE IS A COMPLETE LINE OF CINCINNATI TRAY-TOP AND LT LATHES



Tray-Top — $1793.00†



LT — $4829.00‡

what's so different about

Piercing Color TV Chassis?

Color TV chassis are produced in small lots—require frequent engineering changes—setups and production tools are high cost operations.

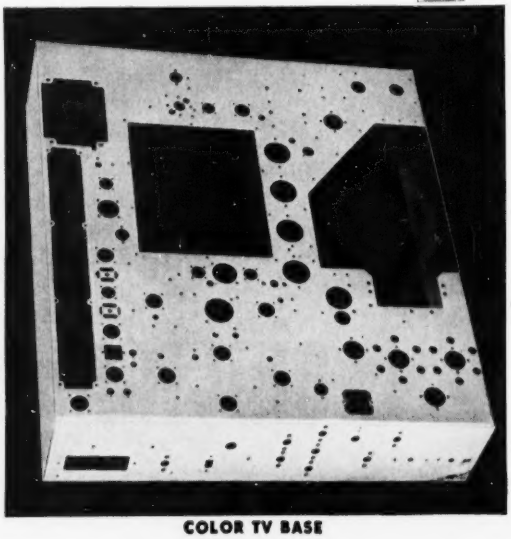
THE WIEDEMANN RA-41P TURRET PUNCH PRESS economically produces chassis and panels in small lots for

COLOR TV
RADAR
FIRE CONTROL
COMMUNICATIONS
BUSINESS MACHINES
AIRCRAFT
and many other applications

because:

- **Setup time is low**
- **Initial tooling cost is low**
- **Punches and dies are re-used on other jobs so tooling cost soon becomes a negligible factor**
- **Engineering changes are accomplished without delay to production schedules and at low cost**
- **Complete flexibility—close hole centers—20 hole sizes in sheets to 28″ x 40″ in single handling —40 to 60 holes per minute located to plus or minus .005″ tolerance**

These advantages combine to make the RA-41P Wiedemann Turret punch press a paying investment to all chassis fabricators, since the RA-41P is the only machine designed for economically piercing electronic chassis and panels in low runs.



COLOR TV BASE
Quantity 55
(Pierced on Wiedemann RA-41P)
530 strokes of press
31 different punches and dies used
(no special tools)
2 handling operations
TOTAL TIME (floor to floor)
per piece 16.25 MINUTES

Write for a copy of Bulletin 241

WIEDEMANN MACHINE COMPANY

4205 Wissahickon Avenue, Philadelphia 32, Pa.

For more information on products advertised, use Inquiry Card, page 241

"AMERICANS" WORKING FOR NORDBERG

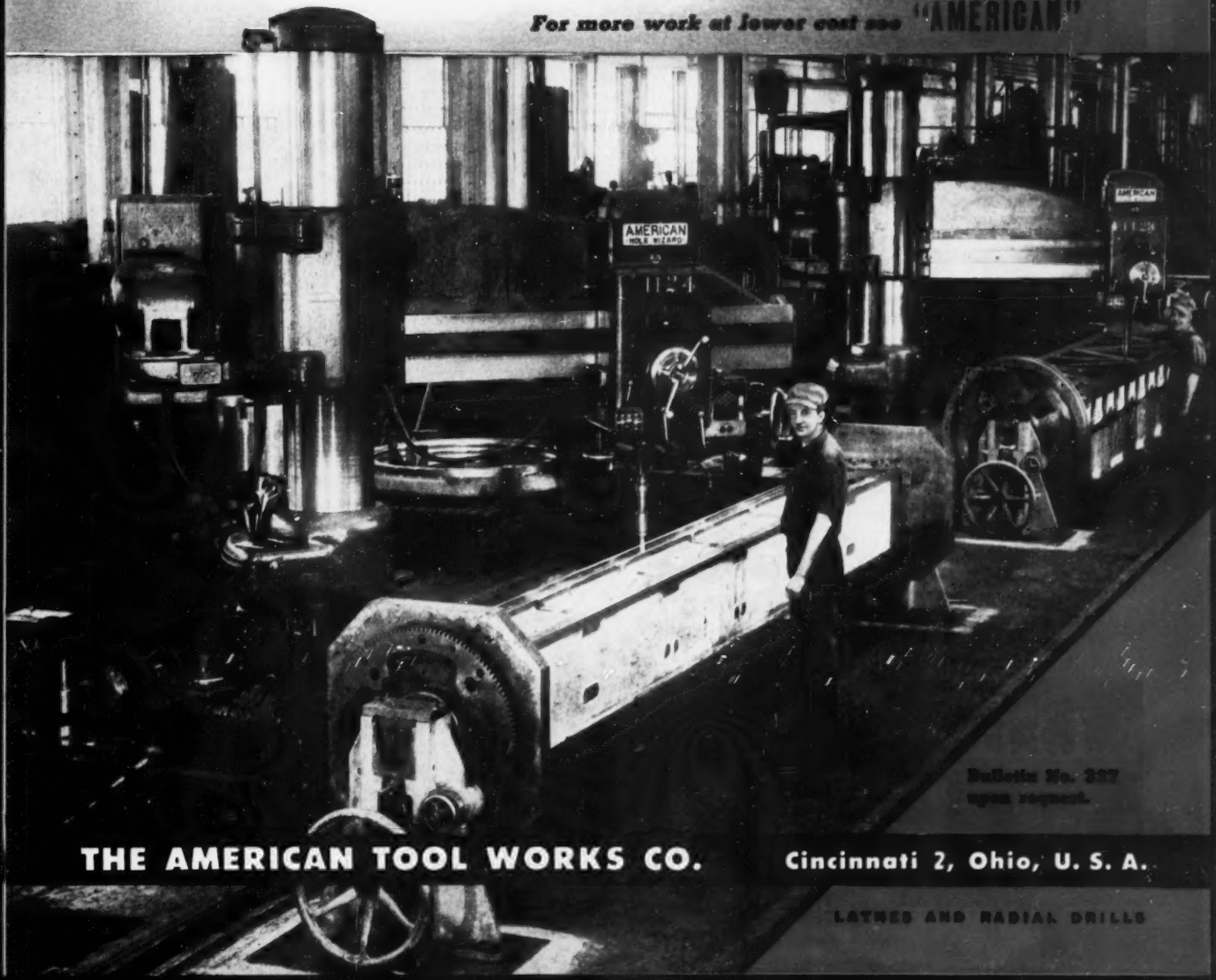
helping to profitably produce the quality products for which Nordberg Manufacturing Company of Milwaukee, Wisconsin is known the world over.

These "AMERICAN" Track Type Hole Wizard Radials mounted on mobile bases speed up drilling, tapping and boring operations in long, heavy work pieces by bringing the tool to the work rather than moving the work to the tool.

The work pieces are mounted in elaborate trunnion jig fixtures so different work planes may quickly be presented to the tool and a high degree of accuracy maintained.

The quality of Nordberg products is universally recognized. We are proud indeed that so many "AMERICAN" Lathes and Radial Drills contribute to it.

For more work at lower cost use "AMERICAN"



Bulletin No. 227 upon request.

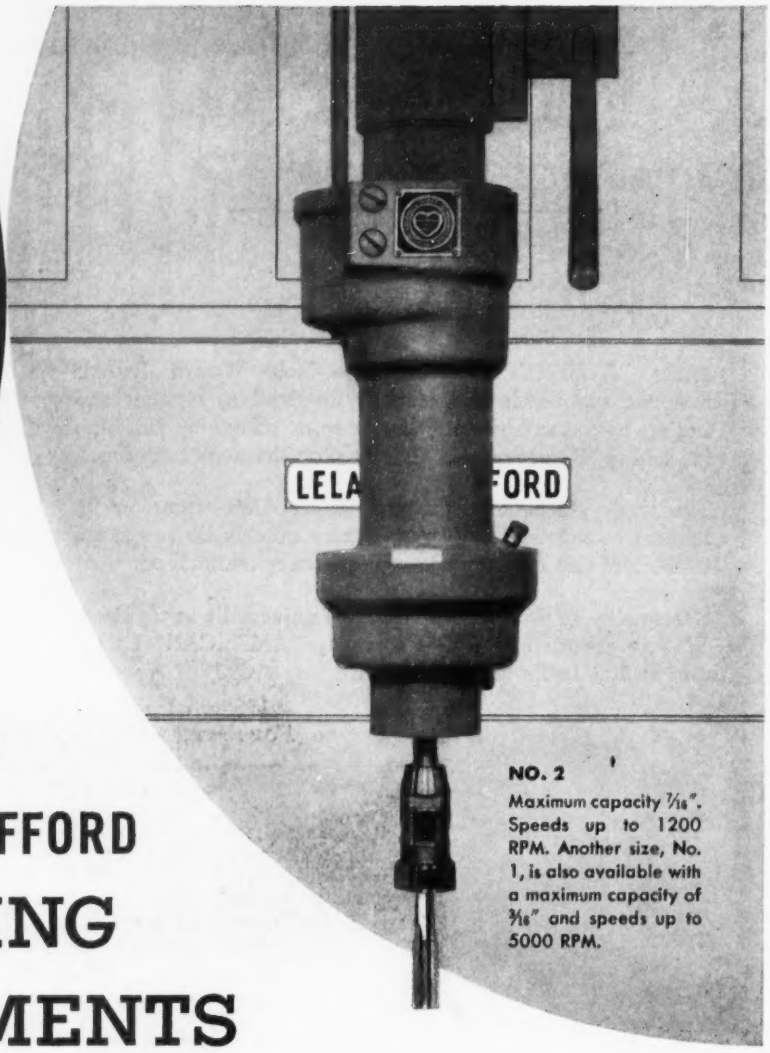
THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

turn potential into profit...

with

LELAND-GIFFORD TAPPING ATTACHMENTS



NO. 2
Maximum capacity 7/16". Speeds up to 1200 RPM. Another size, No. 1, is also available with a maximum capacity of 3/16" and speeds up to 5000 RPM.

Use all the speed, precision and efficiency of your Leland-Gifford Drilling Machines in tapping, too — simply by fitting on a Leland-Gifford tapping attachment.

The operator controls the tapping attachment from the feed lever of the machine — exactly as in drilling. He can thus maintain sensitive, fingertip control at all times — greatly increasing production, tapping to depth with great accuracy and practically eliminating the chance of tap breakage.

Leland-Gifford Tapping Attachments will handle class 3 holes with ease. They attach rigidly to the quill and may be instantly stopped or reversed at any time. Full ball bearing assembly assures smooth operation. Reversal is exceptionally smooth due to the friction of steel acting against Textolite*.

Order one today or write for Bulletin 510-B.

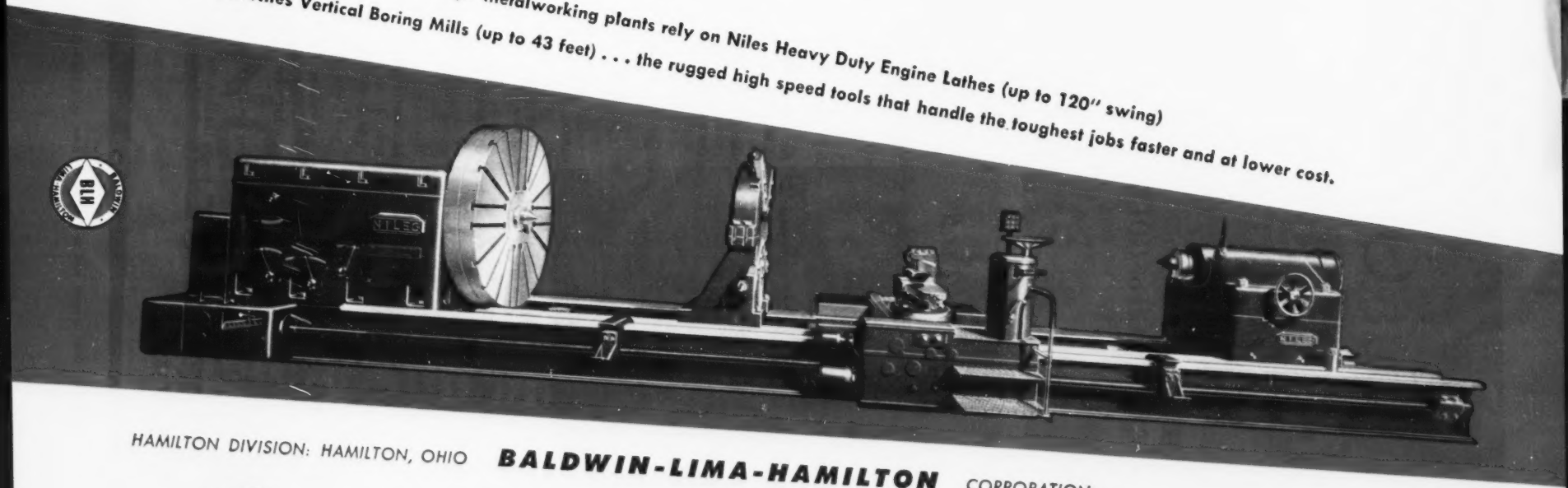
*Plastic impregnated cloth

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U.S.A.

- **CHICAGO 45**
  2515 West Peterson Ave.
- **DETROIT**
  10429 West McNichols Rd.
- **CLEVELAND 21**
  P. O. Box 217
- **NEW YORK OFFICE**
  75 South Orange Ave.
  South Orange, N. J.
- **LOS ANGELES OFFICE**
  2620 Leonis Blvd., Vernon 58, Cal.
- **INDIANAPOLIS 6**
  P. O. Box 1051
- **ROCHESTER 18**
  P. O. Box 67, Roselawn Station

For more information on products advertised, use Inquiry Card, page 241

For their big jobs, "Blue Chip" metalworking plants rely on Niles Heavy Duty Engine Lathes (up to 120" swing) and Niles Vertical Boring Mills (up to 43 feet) . . . the rugged high speed tools that handle the toughest jobs faster and at lower cost.



HAMILTON DIVISION: HAMILTON, OHIO **BALDWIN-LIMA-HAMILTON** CORPORATION

A few of the diverse "Blue Chip" users of NILES TOOLS

Allis-Chalmers
Carrier
Dresser Industries, Inc.
Fairbanks-Morse
Fairchild Aircraft
Maryland Drydock
Massey-Harris
Westinghouse Electric

New Norton Cut-Off Wheels Get Industry's O.K.!

Reports from every section of the country tell how the freer cutting, longer lasting R50 and B9 add the profit-boosting "TOUCH of GOLD"

Here's what they say about–

The R50

143 more cuts
Job: California mine bit manufacturer, cutting nickel steel stock 2⅞" x ½" cross-section on automatic machines.
Report: R50 rubber cut-off wheel best ever used. Gave 735 cuts to competitive wheel's 592, for 24% more wheel life.

Better performance
Job: Connecticut machine tool manufacturer, cutting various types and sizes of steel. (Illustrated, opposite page.)
Report: R50 wheel outperformed competitive wheel on wet cutting of high carbon tool steel, with freer cutting action and a square cut.

120% longer life
Job: Indiana construction equipment manufacturer cutting steel bar stock and tubing.
Report: R50 wheel produced 216 cuts, 120% more than competitive wheel's 98 cuts.

No burn or breakage
Job: Kentucky manufacturer of garbage disposal units, cutting chrome vanadium steel, ⅝" x ¾" cross-section.
Report: R50 wheels eliminated the breakage problem and produced a cut free of burr and burn.

450 more cuts
Job: Missouri manufacturer of coal mining equipment, cutting mine bit bar stock.
Report: R50 handled 12 bars at 90 cuts per bar, totalling 1080 cuts. Beat best previous wheel's record of 7 bars, 630 cuts, by 70%.

Freer cutting, longer lasting
Job: Massachusetts manufacturer of pneumatic tools cutting 1⅛" hexagonal drill rod steel.
Report: R50 wheel proved to be 25% more durable while producing an equal quality of cut. Freer cutting, with less of usual rubber wheel odor.

25% more cuts
Job: Connecticut machine manufacturer, cutting miscellaneous steel stock.
Report: R50 wheel produced 25% more cuts than competitive wheels with equal freeness and cleanness of cut.

The B9

72% more durable
Job: Michigan engine manufacturer, cutting crankshaft spindle arms.
Report: B9 wheel produced 250 cuts over competition's 145, lasting 72% longer on this job.

Lasted three times longer
Job: Ohio metal working company, cutting miscellaneous steel bar stock.
Report: B9 gave this user three times the service life of competitive wheel, with excellent cutting performance.

40% more cuts
Job: Pennsylvania die manufacturer, cutting carbon steel bar stock ½" x 3" cross-section.
Report: B9 wheel out-produced competitive wheel by 40% giving 252 cuts as against 180.

36% production increase
Job: Missouri metal company, cutting heavy wall pipe, 3½" O.D. — 2½" I.D.
Report: B9 gave 75 cuts to competition's 50-55, proving 36% longer lasting.

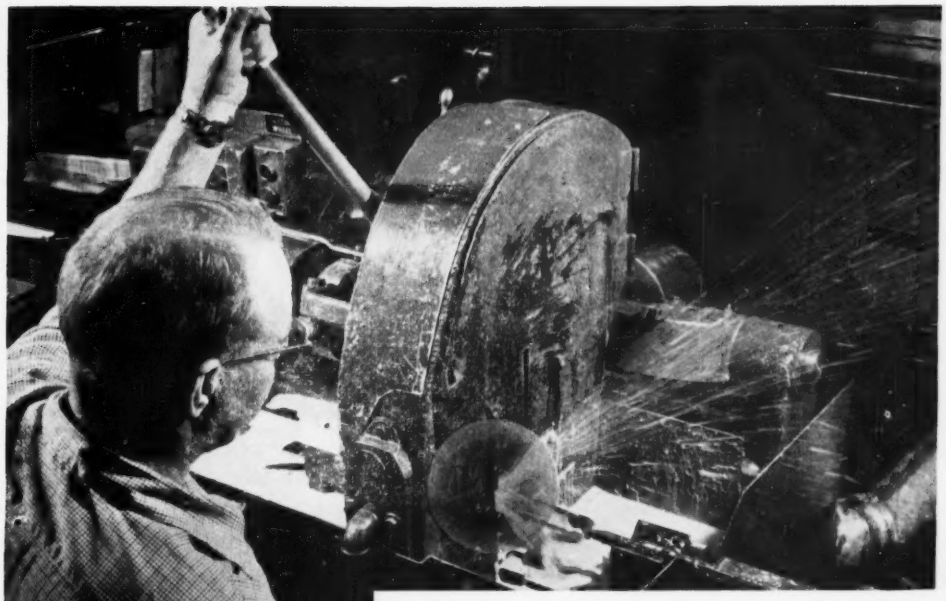
Best wheel ever used
Job: Michigan tool manufacturer, cutting mild steel shank stock.
Report: B9 produced twice the number of pieces previously cut, rated best wheel ever used on this job.

150% over competition
Job: Maryland metal working company, cutting miscellaneous bar stock.
Report: B9 wheel gave 125 cuts, topping competitive wheel's 50 cuts by 150%.

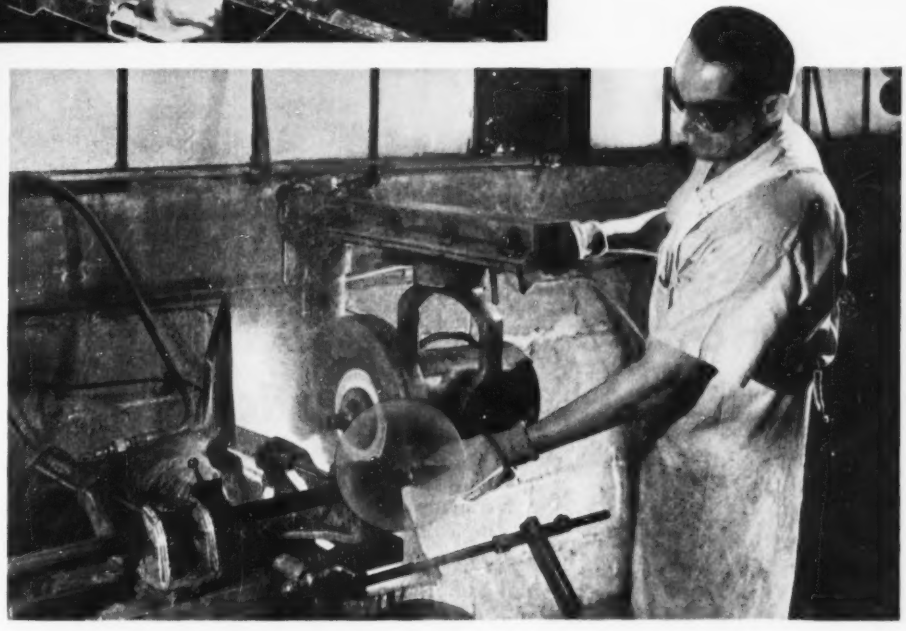
42% more cuts
Job: Pennsylvania construction equipment manufacturer, cutting 1⅛" high carbon drill rod.
Report: B9 averaged 125 cuts, 42% over competition's average of 88 cuts.

85% longer life
Job: California forge and pipe foundry, cutting spiral welded pipe.
Report: B9 lasted 85% longer than any other wheel.

27% more durable
Job: Ohio aircraft manufacturer, cutting a wide variety of bar stock. (Illustrated, opposite page.)
Report: B9 wheel delivered 27% longer life than competition, with faster cutting action and improved quality of cut.



The New Norton R50 rubber bonded cut-off wheel is designed especially for wet-cutting of ferrous or non-ferrous bar stock up to 6" diameter. Built-in chip clearance — a great advancement in this type of wheel — is one of its special "Touch of Gold" advantages that assure freer, faster cutting with maximum strength and service life.



The New Norton B9 resinoid bonded cut-off wheel is made with either smooth sides or with the rough "F" sides for more clearance in the cut. It is a high production wheel, cutting free and cool with minimum burning. It will give you long, economical "Touch of Gold" performance in the widest range of ferrous and non-ferrous applications.

Performance reports like these are coming in every day telling how the new Norton R50 and B9 cut-off wheels are setting new records for extra long service life and improved cutting action. Check them carefully, then judge for yourself how much your own cutting-off operations will benefit by these outstanding wheels. And remember: for every cut-off job you do, there's a Norton cut-off wheel that will add the money-saving "Touch of Gold."

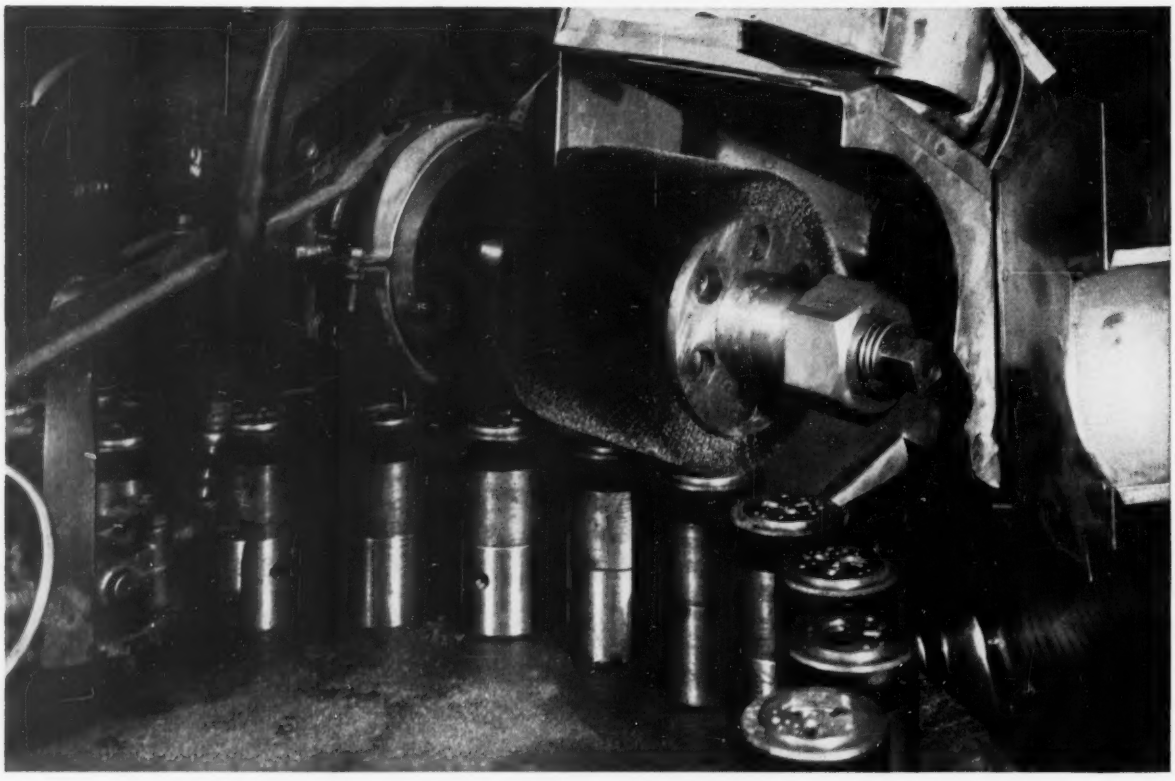
See Your Norton Distributor for the cut-off wheels you need. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your classified phone directory. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts. W-1568

Making better products. . . to make other products better

NORTON

and its BEHR-MANNING division

NORTON: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes



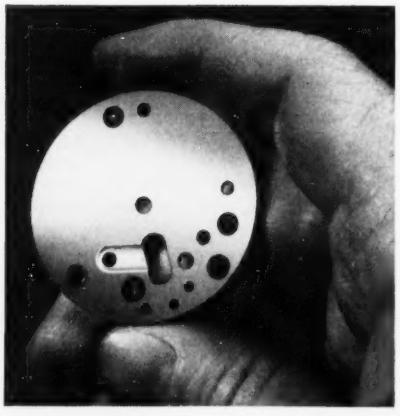
How to brush down finishing costs *automatically*

Power Brushing finishes both sides of these brass discs at a rate of 15,000 per machine per eight-hour day. It does a better, more uniform job many times faster than hand methods.

Parts are placed on spindles which rotate at 60 r.p.m. The table also turns at about one revolution in 25 seconds bringing the Osborn Economy Section Brushes into contact with each part in turn. Spindles stop rotating as they approach the loading station, where a mechanism lifts finished parts and air pressure blows them into a chute.

A similar automatic operation with Osborn Power Brushing may improve the quality and speed of *your* cleaning, finishing and deburring operations . . . whether you process large parts or small . . . made of metallic or non-metallic materials. Ask your nearby **O**sborn **B**rushing **A**nalyst to appraise *your* possibilities. Write to *The Osborn Manufacturing Company, Dept. O-20, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

FREE: New booklet on deburring with Osborn Power Brushing. Ask for your copy.



The finished part. Osborn Power Brushing removes feather burrs and blends surface junctures.

Osborn Brushes

OSBORN

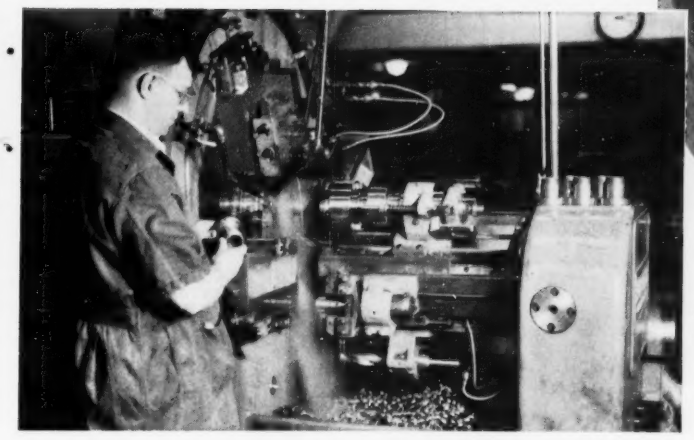
OSBORN BRUSHING METHODS • POWER, MAINTENANCE AND PAINT BRUSHES • BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

For more information on products advertised, use Inquiry Card, page 241

Baker INDUSTRIAL TRUCKS tells us...

"we used to average 2 of these pieces per hour ...from 2 machines with 2 operators

now we get 10 pieces with just 1 machine and 1 operator..."





This commutator core, actual size, is completed in one set-up with HS tools. Close reaming, trepanning and class 3 thread are required.

. . . on the 5½ inch Model M Acme-Gridley Single Spindle Automatic

Another case-history report, this time from Baker-Raulang, Cleveland, O., one of the most experienced (101 years old) makers of power industrial trucks and tractors.

This 5 to 1 production gain is the average, though we can show you where and how other Model M customers are getting as much as 10 times their former output. And we believe that such down-to-earth documented evidence far outweighs vague promises, hearsay or experimentation at your expense.

May we give you more information, especially figures on your specific single spindle jobs? Why not let us show you what this machine actually has accomplished... with carbide tooling, easy change-overs, operating conveniences... performance facts that make such claims of highest output at lowest costs a REALITY?

If this bar machine offered ONLY

predetermined automatic control of the job time-cycle...

this complete machining of every piece at the same predetermined rate at the end of a shift as at the start would mean faster and more accurately scheduled production. But, when additional operations can be put on to complete the job, or more nearly complete it, on ONE machine—and eliminate present unnecessary added cost for extra man hours and release these extra machines and floor space to other needs—THEN certainly it is important that you have such guarantees to make comparisons on your own work.

The NATIONAL ACME COMPANY

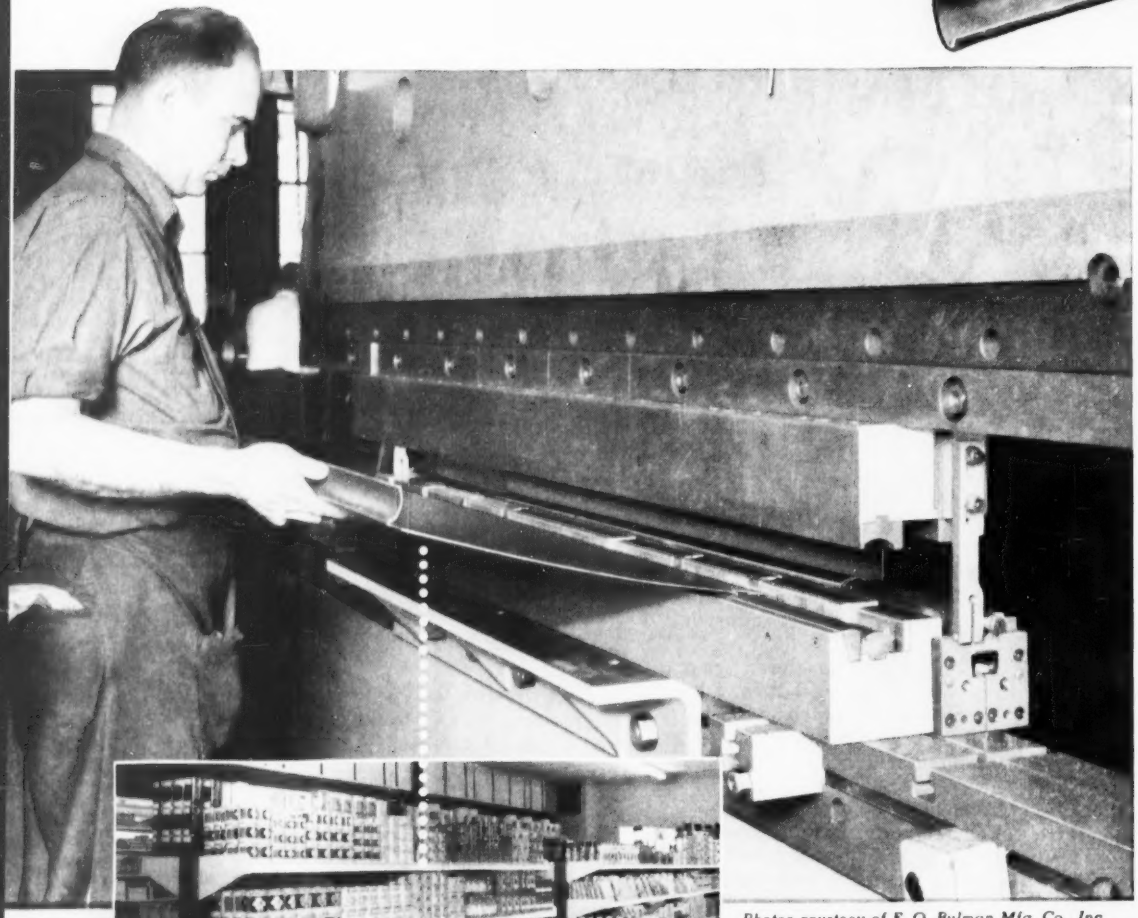
170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing

Remember—You can't do **TODAY'S JOB** with **YESTERDAY'S TOOLS**... and be in business **TOMORROW**

Only accurate forming

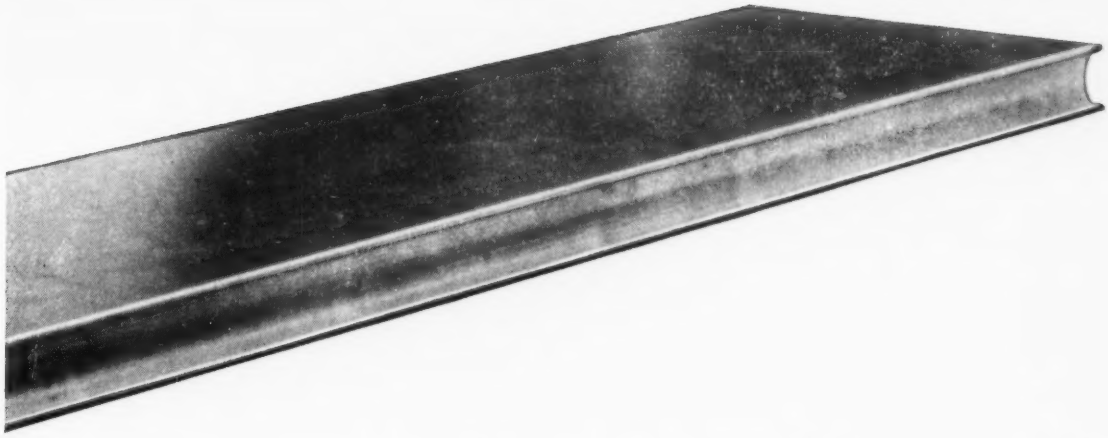






Note the clean straight lines of the moldings formed on the Cincinnati Press Brake.

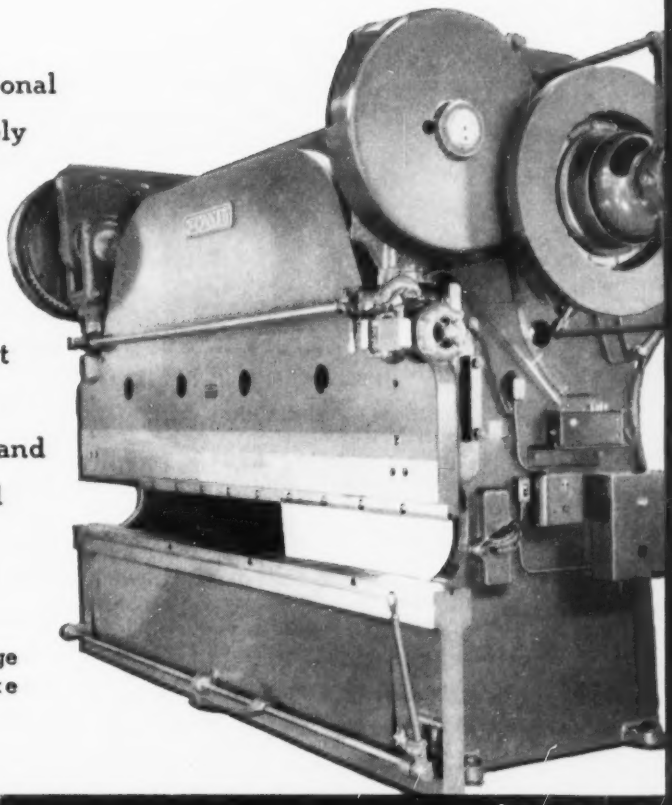
Photos courtesy of E. O. Bulman Mfg. Co., Inc., Grand Rapids 2, Michigan.



...could solve this problem

The long steel shelves of these sectional display racks are formed so accurately that sections match perfectly with lines straight and clean.

The Cincinnati Press Brake is forming to such close tolerances that a masking strip previously used is eliminated. A production increase and no discards has materially reduced costs while product was improved.



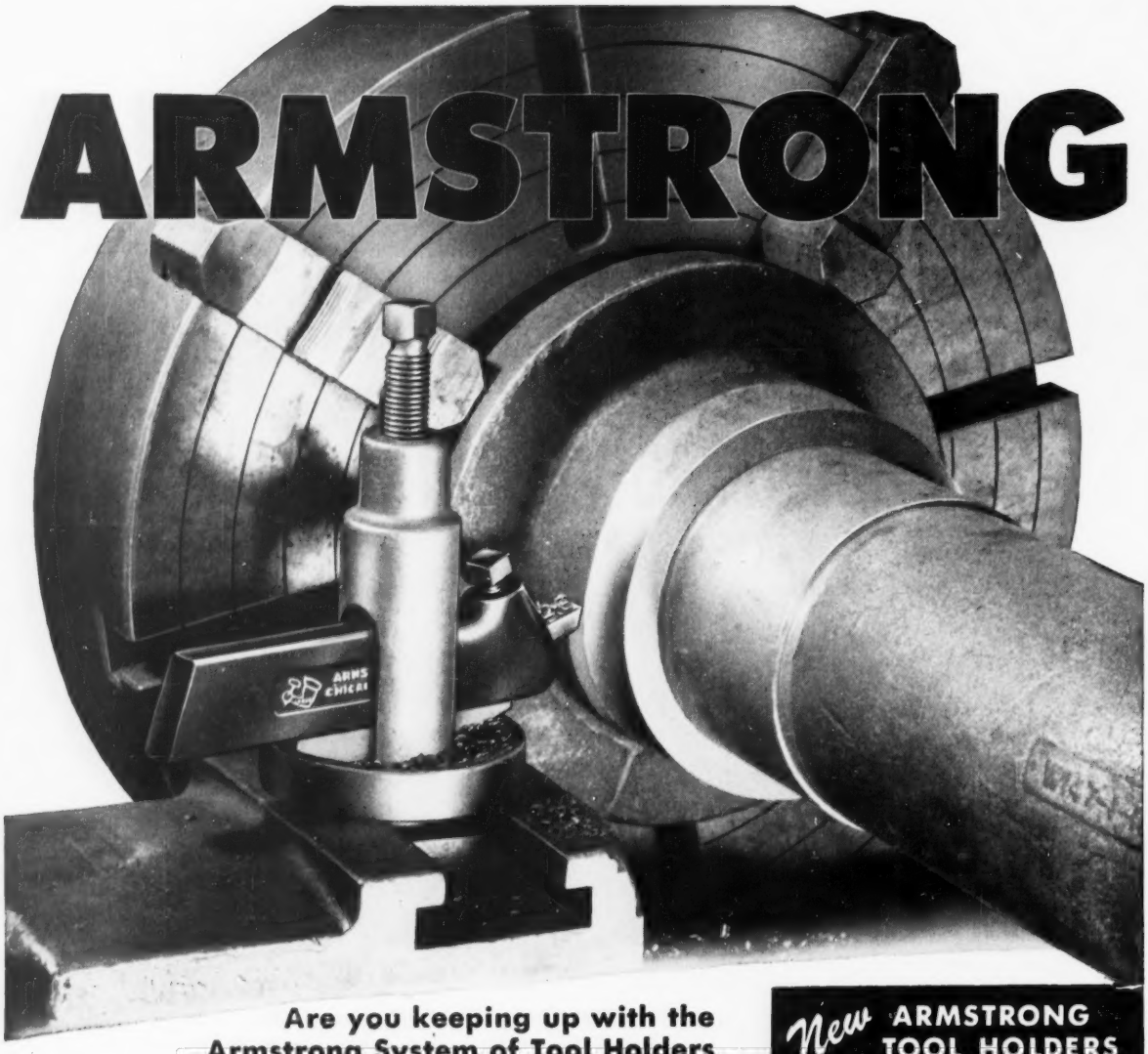
Write for the New 72-Page Cincinnati Press Brake Catalog.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

ARMSTRONG



Are you keeping up with the Armstrong System of Tool Holders

Doubtless you are daily using ARMSTRONG TOOL HOLDERS that have been in continuous operation for many years. This is sound practice, for this means added profits without added tool costs. But to become complacent, so satisfied that you forget your ARMSTRONG TOOL HOLDERS, is unwise. The "Armstrong System" is a growing thing, with new types and sizes of ARMSTRONG TOOL HOLDERS constantly being developed to more effectively meet new machining conditions, or to take advantage of newly developed cutting materials.

With modern ARMSTRONG TOOL HOLDERS for each operation, you can greatly increase speeds and feeds. You can lower machining cost and further increase profits.

If you haven't kept up with the "Armstrong System" write for an ARMSTRONG Catalog and check to see that you are using the most efficient ARMSTRONG TOOL HOLDER for each operation on all lathes, planers, slotters and shapers.

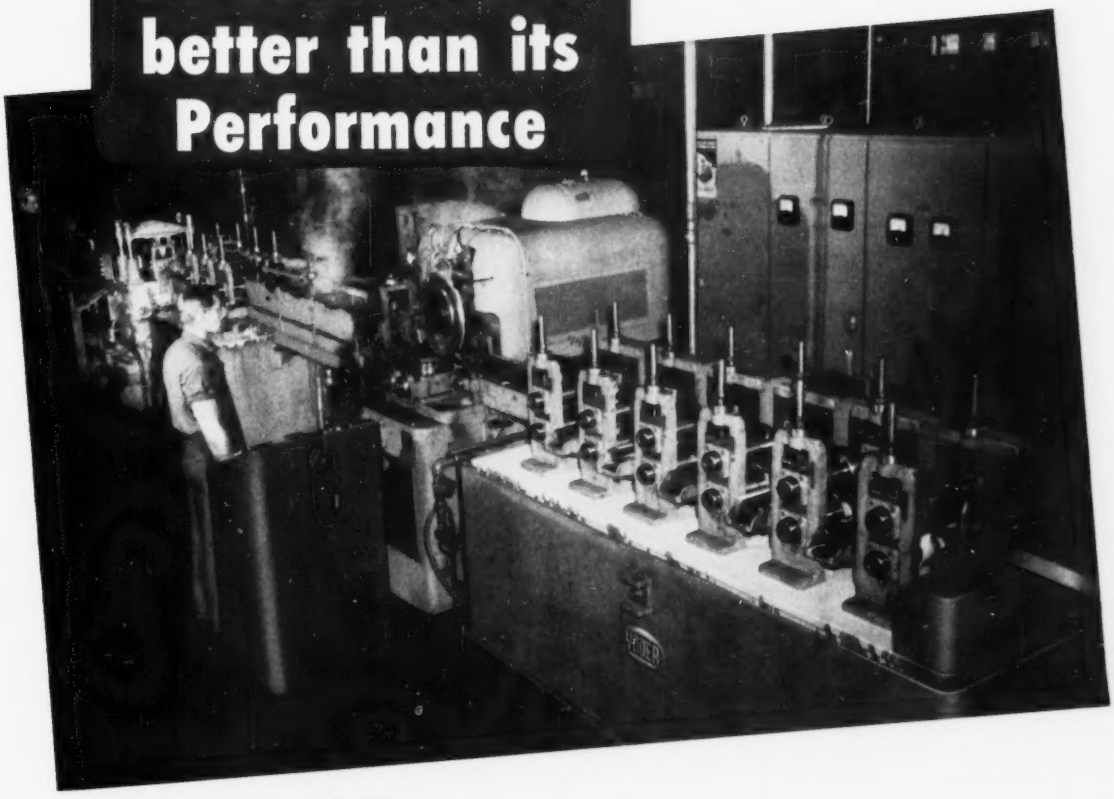
WRITE FOR CATALOG



ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"* 5213 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

For more information on products advertised, use Inquiry Card, page 241

No Tube Mill is better than its Performance



Above: One out of three Yoder Tube Mills at Standard Steel Spring Co., Trenton, N. J. and Los Angeles, Cal.

Performance means production of good tubing, with minimum scrap losses, not only per hour or per day, but year in and year out. On this basis Yoder mills are most profitable in the long run.

Yoder mills have always been noted for their consistently high output, high weld strength and low scrap losses. Today, with the new Yoder 4-in-1 Cross-type Welding Transformer and other new features, their performance is more outstanding than ever.

And because most prospective buyers carefully investigate and compare performance records, there are more Yoder mills sold and in use than of all other electric resistance weld mills combined.

The Yoder Tube Mill Book tells the story of electric-weld tube making and answers many questions of interest to prospective tube mill owners. It's yours for the asking.

THE YODER COMPANY • 5504 Walworth Avenue, Cleveland 2, Ohio

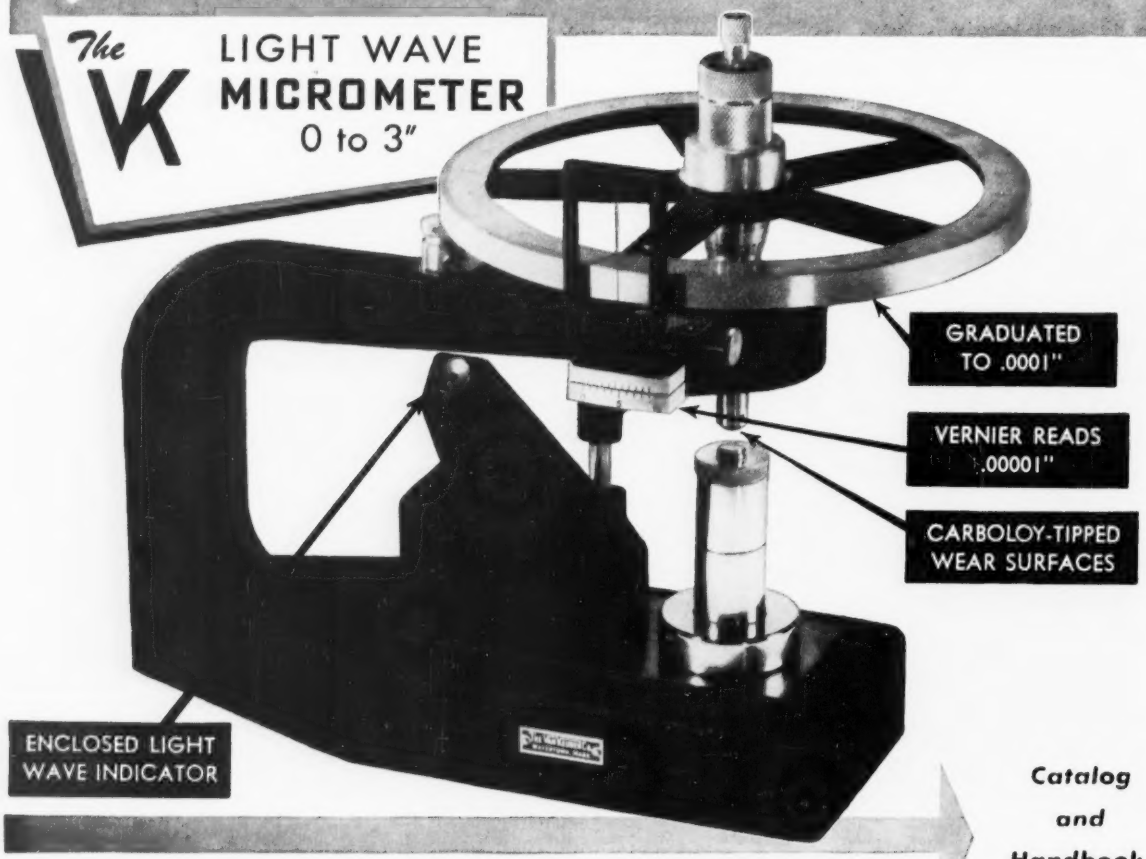
Complete Production Lines

- ★ COLD-ROLL-FORMING and auxiliary machinery
- ★ GANG SLITTING LINES for Coils and Sheets
- ★ PIPE and TUBE MILLS–cold forming and welding

ENGINEERING YODER MANUFACTURING

for that last hundred-thousandth

The VK LIGHT WAVE MICROMETER 0 to 3"



The Van Keuren Light Wave Micrometer is an instrument of exceptional accuracy, ideal for measuring plug gages or small precision parts. Use it when you're after "that last hundred thousandth" involved in so many of today's measurements. The 0 to 3" instrument shown above has a ½" diameter, 40 threads per inch micrometer screw, which can be made with greater accuracy, and which has 3 times the wearing surface of an ordinary micrometer screw. It has an 8" diameter micrometer wheel, with .0001" graduations 1/10" apart. It has a non-parallax vernier index which enables readings to be made to .00001". It has an index lock and carboloy-tipped anvil and spindle. This sturdy, sensitive instrument weighs only 17 pounds, and is in reality a portable measuring machine of inbuilt and sustained accuracy.

The Light Wave Micrometer is not a comparator. No gage blocks are needed and no errors creep in from worn blocks. It is a direct source of dependable precision . . . fast, accurate and profitable.

Catalog and Handbook No. 35

This 220-page volume represents years of research by the Van Keuren Co. It presents a simple and exact method of measuring screws and worms with wires, tells how to measure gears splines and involute serrations. It is an accepted reference book for measuring problems and methods. Ask for your copy . . . sent free on request by writing: The Van Keuren Company, 178 Waltham St., Watertown Mass.

VK

35th YEAR

THE *Van Keuren* CO.,

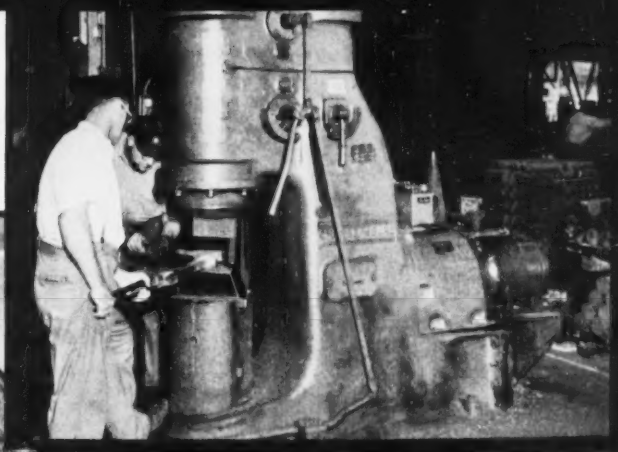
178 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires Chrome Carbide Taper Insert Plug Gages

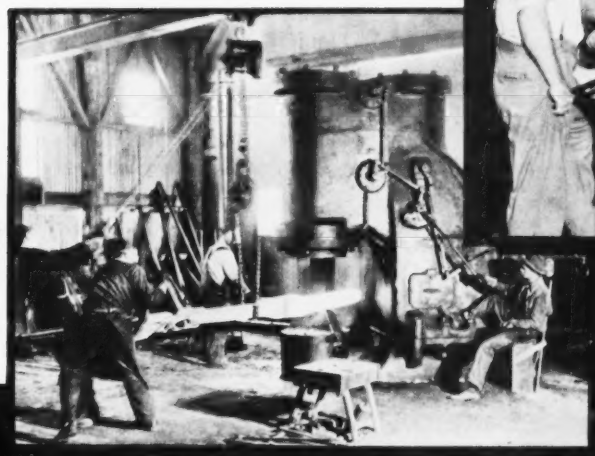


For more information on products advertised, use Inquiry Card, page 241

Blacksmithing



Parts Forging





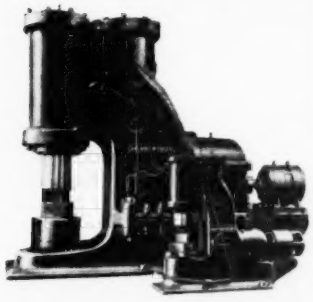
Maintenance

Repairs



THE VERSATILE HAMMER

SELF-CONTAINED • PNEUMATIC

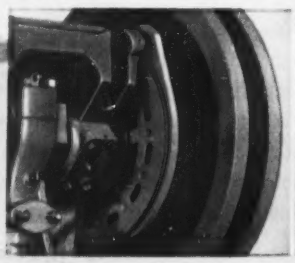


The Chambersburg Motor Driven Pneumatic Forging Hammer is a self-contained forging unit that can be installed independent of steam or air lines and is capable of handling a wide variety of forging work from simple blacksmithing to machinery repair and maintenance work. It has a built-in motor driven air compressor and can be installed wherever electric current is available. Heavy anvil, high impact speeds, powerful blows and easy control of blows distinguish this versatile hammer. Sizes 200 lbs. to 5000 lbs. Write for a copy of Bulletin 16-L-9.

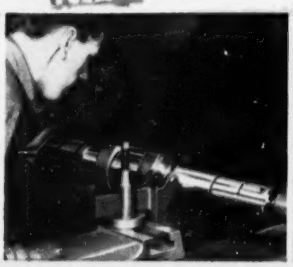
CHAMBERSBURG ENGINEERING COMPANY

CHAMBERSBURG • PENNSYLVANIA

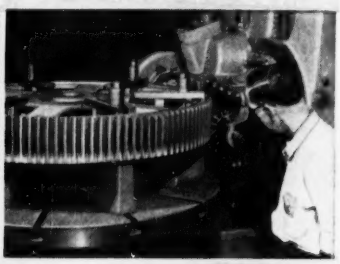
DEPENDABILITY...



■ Minster combination friction clutch and brake. Fast, shockless engagement . . . one nut adjustment . . . low maintenance.



■ Bearing surfaces of unusual accuracy are obtained at Minster by roll burnishing the machined and ground crankshaft.

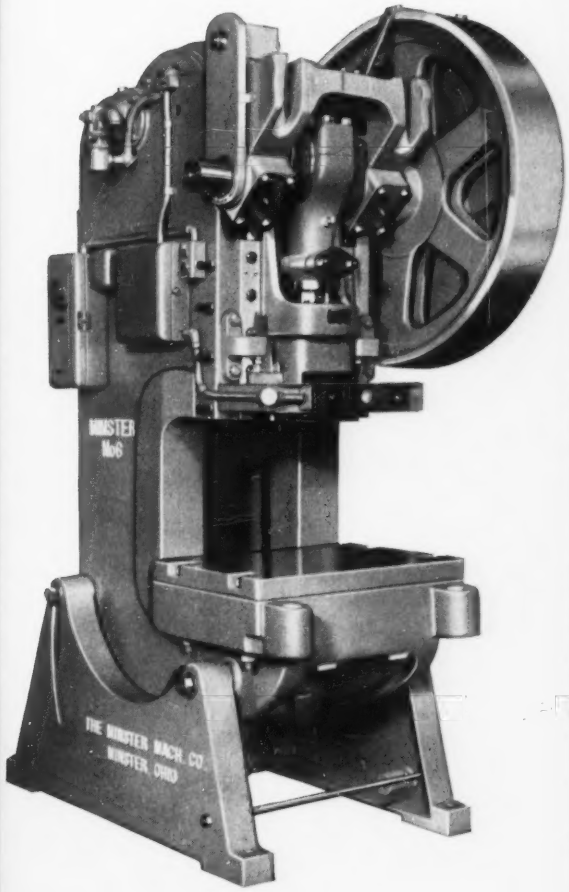


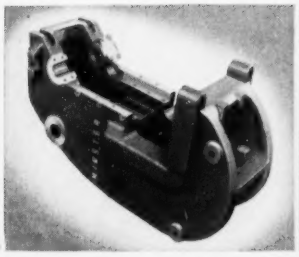
■ Another example of Minster's self-integrated facilities—precision gear hobbing under control of Minster machinists.

you get it with a Minster Press

■ When your machine performance audits are completed you'll find Minster presses rating A's for dependability. Month after month, year after year, Minsters pile up production records worthy of their reputation for being "first in press design."

As the smaller illustrations below indicate one major reason for Minster dependability is attention to *all* the details. The sum total of these details help make a press that has no superior for profitable operation over long periods of time. Next time, specify Minster presses.





■ Heavy frames with extra protection against deflection characterize Minster presses. Here is mass that insures rigidity.



■ Close control of casting quality is demanded in Minster's own foundry. Illustrated: micro-inspection of grain structure.

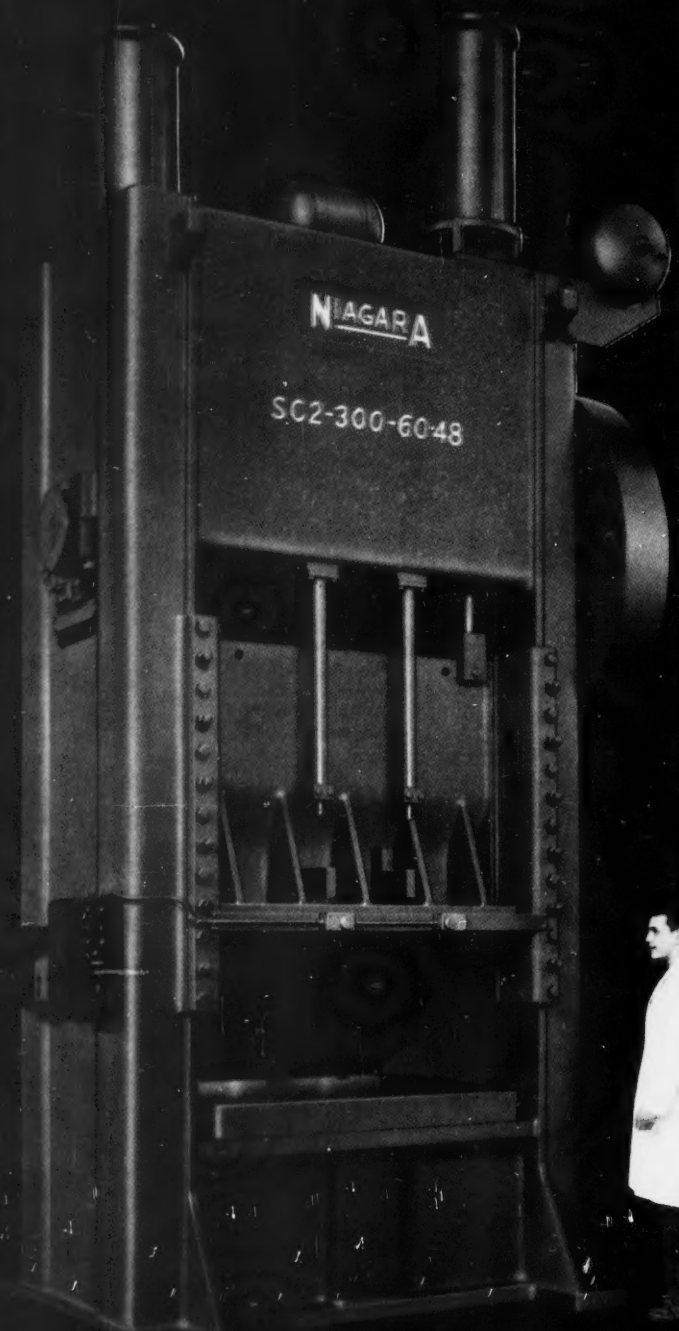
THE MINSTER MACHINE CO.

MINSTER

FIRST IN PRESS DESIGN

MINSTER, OHIO

LOOK TO THIS NEW, PRODUCTION-BOOSTING LINE



50 THROUGH 300-TON CAPACITIES

NIAGARA MACHINE & TOOL WORKS 75 1879 1954

America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work

For a realistic answer to the metal stamping and forming problems of today... and tomorrow

DESIGN MODERNIZATION CONCEALS DRIVING MECHANISM

Fully streamlined, enclosed construction, front and back, provides pronounced advantages. There are no exposed, overhanging flywheel, clutch, brake, intermediate shaft, nor motor in rear of press to obstruct crane service, block light, throw grease and consume floor space unnecessarily ... yet all parts are quickly accessible.

WORK-SAVING FLEXIBILITY MEETS SHIFTING PRODUCTION NEEDS

Box type welded steel slides are power adjusted through self-locking, worm driven, barrel type connections to accommodate a wide range of die heights and to permit quicker, easier and safer die setting. Niagara electric clutch control provides trouble-free push button operation and a five-position selector switch for ease, safety and efficiency in single stroking, continuous running, jogging, reverse jogging and slide adjustment.

RUGGED, HEAVY DUTY FRAMES PROLONG DIE LIFE

All-steel, rigidly constructed frames, featuring an exclusive triple box section design, provide maximum resistance to deflection from horizontal, diagonal and torsional stresses. Greater accuracy and longer die life are thereby assured.

GREAT SHUT HEIGHT AND LONG SLIDE ADJUSTMENT

Unusually liberal shut height and extremely long slide adjustment, of both one and four-piece frame construction, permit use of a tremendous range of stamping and forming dies.

Hailed as the most progressive step in straight side, double crank press history, the new Niagara SC-2 Press Series could only have originated from a keen insight of today's metal working problems and the more challenging ones of tomorrow. In every detail of design, you'll recognize the unduplicated competence of Niagara engineers. Who else would be more mindful of press users' needs than the men who design and build America's leading and most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work?



CHECK THE FEATURE-BY-FEATURE EVIDENCE

Preview this complete new line of straight side presses at once. Find out what they can do for you. Write for Niagara's new, illustrated Bulletin 64-H today.

NIAGARA MACHINE & TOOL WORKS
BUFFALO 11, N. Y.

DISTRICT OFFICES:
Detroit • Cleveland • New York • Philadelphia
Dealers in principal U. S. cities and major foreign countries

NIAGARA

STRAIGHT SIDE DOUBLE CRANK PRESSES

For more information on products advertised, use Inquiry Card, page 241

"Was almost ready for the Scrap Heap—



...but NOW LIKE NEW"

It doesn't look it today—after Simmons Engineered Rebuilding has restored it to peak efficiency. But this 42" Vertical Turret Lathe once creaked, groaned, and sagged at its metal seams. It was slow, inaccurate, required undue maintenance work and expense.

Before Simmons Engineered Rebuilding: Ways scratched and badly worn, main spindle out of alignment with column, turret mechanism worn and unable to perform accurate work.

After Simmons Engineered Rebuilding: Main spindle reseated and realigned, main column ways scraped, planed and ground. Locking cams, pins, bushings and other components of turret mechanism inspected and replaced where necessary. Gear boxes rebuilt. Two important modernization features added: Drive changed from straight to smoother, more effective spiral gearing; belt changed from flat to V. Entire unit rebuilt and tested against original manufacturer's specifications and operating standards.

You, too, can gain and save with Simmons Engineered Rebuilding:

- Save 50% or more of new machine tool cost.
- Save tax money—amortize rebuilding expense over current year, charging it off to maintenance rather than capital investment.
- Save time—delivery in a matter of weeks.
- Increase production—by restoring your present machine tools to peak efficiency, greater speed and capacity.

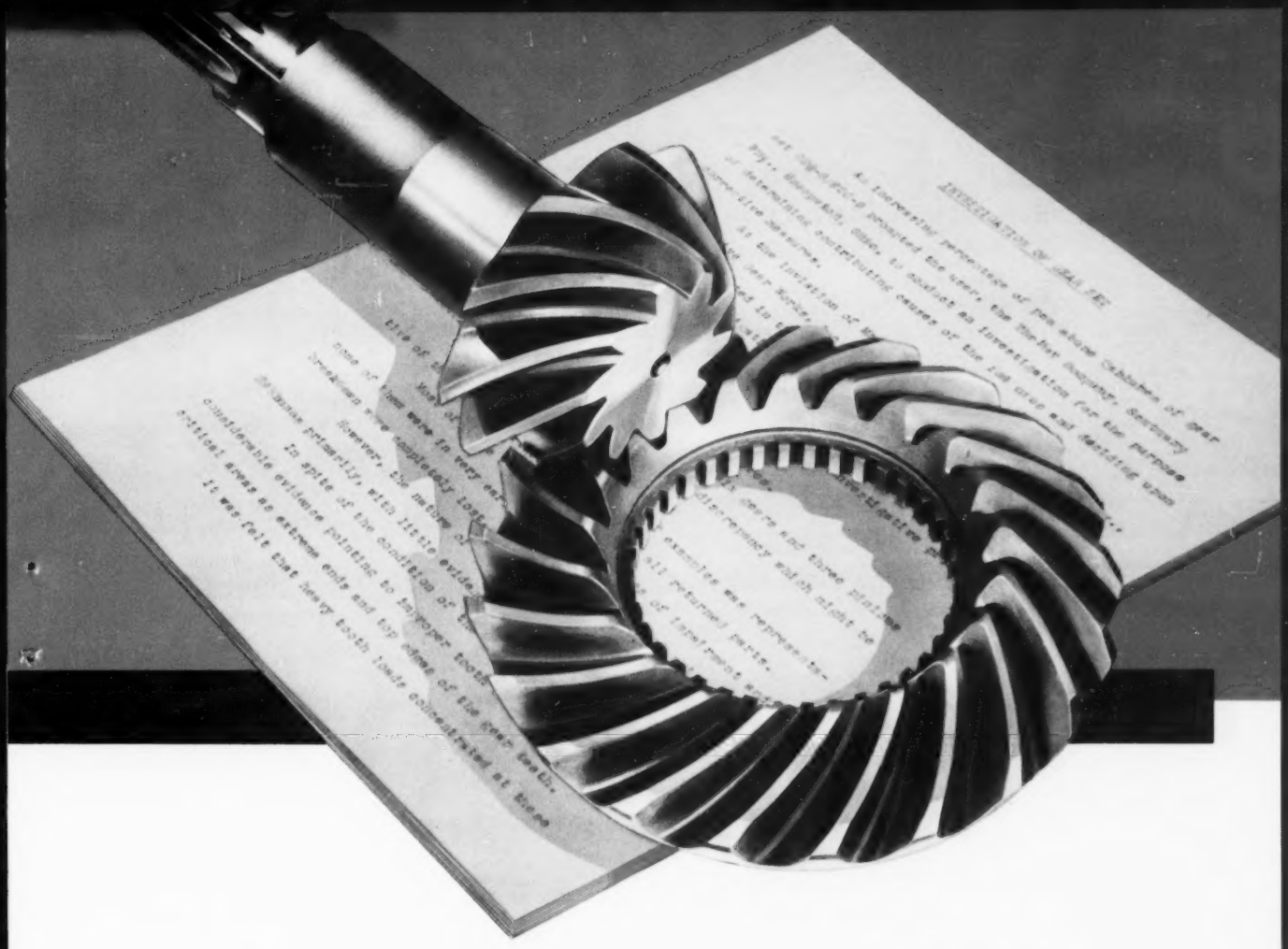
Simmons rebuilds and modernizes all types of machine tools—horizontal and vertical grinders, mechanical and hydraulic presses, milling machines, planers, lathes, and many one-of-a-kind special purpose machine tools.

It will pay you to make a detailed study of your machine tools and their production records. Where some aren't performing up to par, list them for rebuilding. Send this list to Simmons. We'll quote prices promptly. If necessary, our engineers will make an on-the-spot analysis. Write, wire or phone today.

Simmons Machine Tool Corporation
1600 North Broadway, Albany 1, N. Y.
New York Office: 50 East 42nd Street
Phone in New York: MUrray Hill 2-5941

SIMMONS ENGINEERED Rebuilding
GIVES MACHINE TOOLS A NEW LEASE ON LIFE

For more information on products advertised, use Inquiry Card, page 241





BETTER GEARS

via Pullman and Paper Work

A lot of time, travel, study, and testing can go into the improvement of gears.

The report and gear set shown above is a case in point. The 4,000-word report was prepared from facts gathered at the customer's plant. It details performance factors right down to the ground—pin-points every specification that will produce better gears to do a better job.

From this study trial sets were made, tested exhaustively *at* the customer's plant *in* his product.

Then the order was received.

Not all gear problems are as tough as this. But when you're faced with *any* gear problem, write us the facts, telling us where you are and when we can see you.

DOUBLE DIAMOND GEARS

FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS
GEAR-MAKERS TO LEADING MANUFACTURERS

Automotive Gear Works, inc.

ESTABLISHED IN 1914 RICHMOND, INDIANA

NEW!

PARALLOC Dial Snap Gages "D" (Direct) TYPE

Introducing a new type of pin locking mechanism which maintains constant parallelism between anvil faces.

8 SIZES, each with 1" range, cover over-all range 0" to 8"



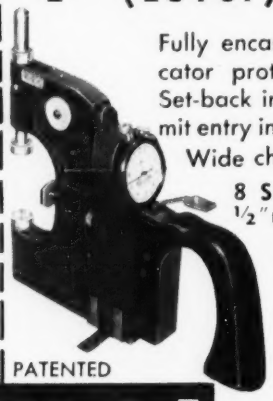
PATENTED

NEW!

PARALLOC Dial Snap Gages "L" (Lever) TYPE

Fully encased movement and indicator protected against damage. Set-back indicator and handle permit entry into narrow recesses. Wide choice of indicators.

8 SIZES, each with ½" range, cover over-all range 0" to 4"

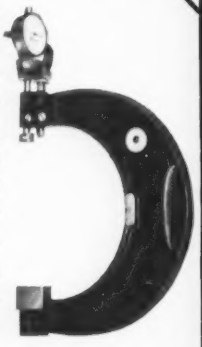


PATENTED

NEW!

Dializers®

STANDARD's original device for converting AGD Adjustable Limit Snap Gages to *DIAL* Snap Gages now available with wide range of indicators from 1⅛" to 2¼" diameter, graduations of .001", .0001", .0005" and .00025", and a wide variety of dial markings, including metric.



Available separately for your frames or assembled in AGD frames supplied by us.

PATENTED

PATENT APPL. FOR

NEWS!

STANDARD GAGE presents a number of NEW PRODUCTS

each deliberately designed to help you do a better job

Dial Bore Gages



Three new models extend dial bore gaging range by intermediate steps down to ⅛" diameter. Each utilizes STANDARD's new, highly practical CENTERING-SIZE DISC principle. Simple in design, easy to set, easy to use, but amazingly accurate and effective in small bore gaging.

STANDARD Dial Bore Gages now available in 10 sizes covering range from ⅛" to 24"

PATENT APPL. FOR

NEW!

PARALLOC DUAL THROAT Midget Dial Comparator



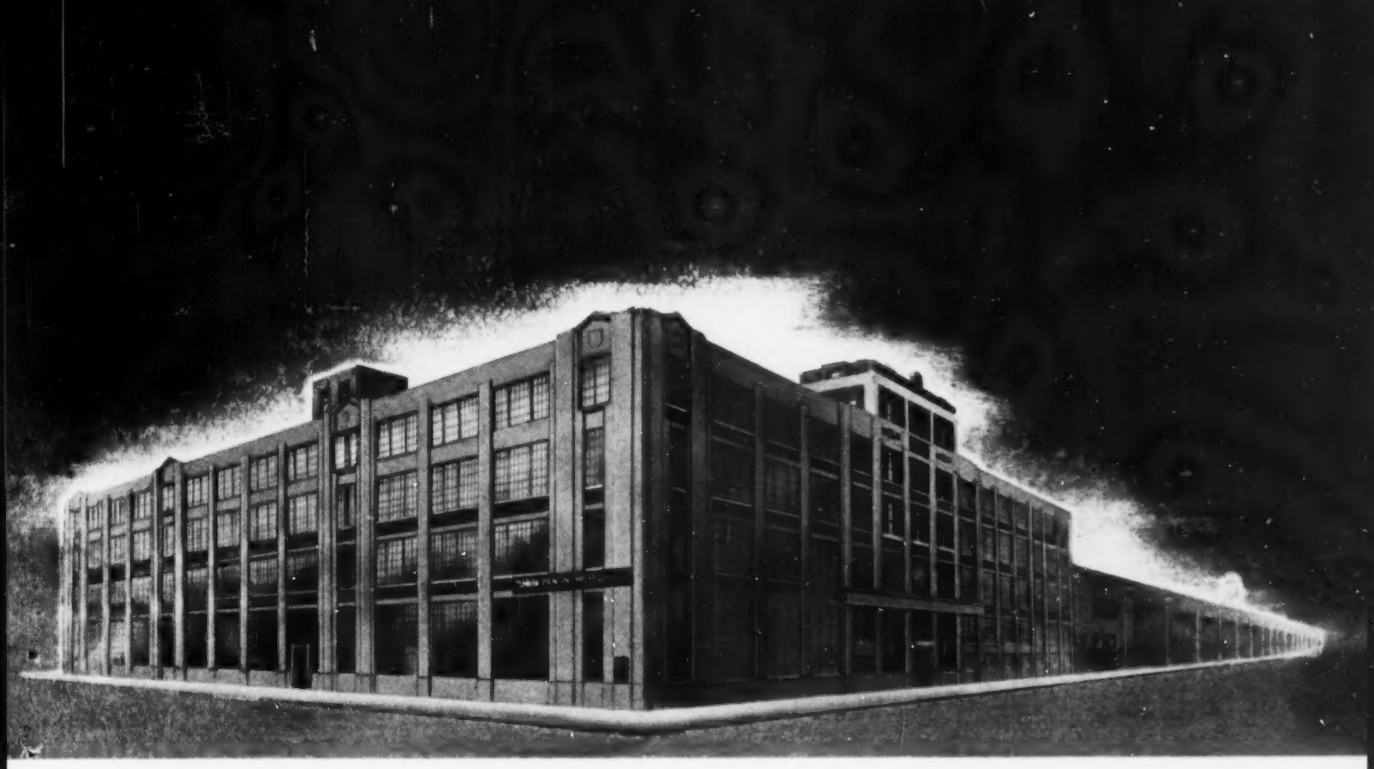
A most useful and versatile gaging instrument. Upper throat is deep, for measuring flat work pieces and stock. Lower throat designed for gaging small round or cylindrical pieces. Three-eighth inch range. May be used as dial comparator at inspection bench, or gage may be detached and brought to work piece like a dial snap gage.

We invite your investigation and trial of these new gages, each designed to help YOU.

STANDARD Gage Co., Inc.
Poughkeepsie, N.Y.

Write for brochure on "NEW PRODUCTS" for more complete details on these instruments.

For more information on products advertised, use Inquiry Card, page 241



How MIEHLE plans for machinery purchases

"The Miehle Printing Press & Mfg. Company, Chicago, recognizing the need of a sound policy covering the acquisition of machinery, has put into operation a program which is here briefly described.

"The machinery acquisitions fall into two general classifications: replacements and additions. Replacements, generally speaking, are for the purpose of increasing the production of current products, for the manufacture of new products, to make products which were formerly subcontracted, to improve quality, or to reduce costs.

"Near the end of each fiscal year, a plant survey is made by production and plant engineering personnel. Worn or obsolete machinery, as well as contemplated additional machinery, is listed and a budget of estimated expenditures for the ensuing year is prepared. This budget is written in detail, giving description and estimated cost of each item. Before the purchase of any item for cost reduction is authorized, it is subjected to analysis under the MAPI formula.

"A post audit of the MAPI figures is made after the machine has been in operation for one year to determine whether the expectations in the original analysis are comparable with the actual results. By this means it is possible to determine whether tendencies to over or under-estimate exist and to make adjustments in future computations accordingly. We believe that the practice of applying the MAPI formula to contemplated purchases of machinery enables us to make a thorough and scientific analysis of our requirements."

F. M. BENDER
Vice President - Manufacturing

ROCKFORD
INSERT
GROUP

Keep Gathering Metal-Working
Production Ideas . . . Be Well
Informed When The Time
For Replacement Arrives . . . . .

Production Increased

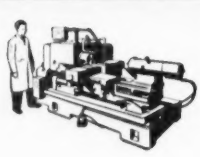


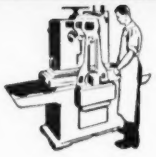
...with SUNDSTRAND Automatic Lathes

Two Sundstrand Model 8A Automatic Lathes are used for turning fitting yokes, slip yokes and weld yoke parts for the Mechanics Universal Joint Division, Borg-Warner Corp. of Rockford, Illinois. Use of these two Sundstrands has increased production over five times compared to former method. In addition to the production increase, tool life and finish has been improved.

SUNDSTRAND "Engineered Production" Service*
*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS









MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

More Than 5 Times



10 Different Jobs Turned In Lot Sizes of 500

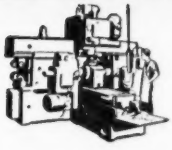
Operation for these yoke parts consists of turning the O. D. complete, using carbide tipped tools. Changeover time is *25% less* than with former method. One operator handles both machines. This is only one of many installations wherein Sundstrand Automatic Lathes have increased production. If you have turning operations, call in a Sundstrand engineer and get an "Engineered Production" analysis. There is no obligation for this service.

Additional Data

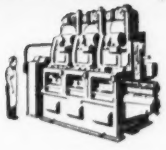


ADDITIONAL DATA on the complete line of Sundstrand Automatic Lathes is included in this new 32-page booklet. Write for your copy today. Ask for bulletin 646.

TRIPLEX RIGIDMILS



SPECIAL MACHINES



SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



Rehnberg-Jacobson

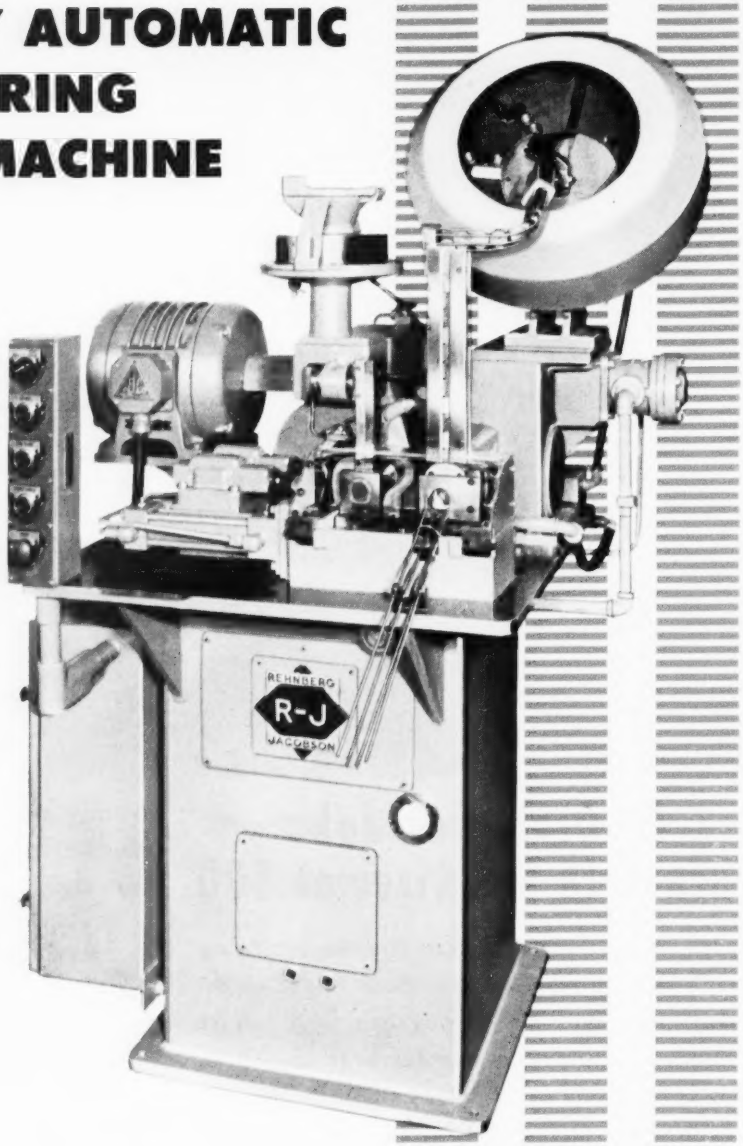
COMPLETELY AUTOMATIC NEEDLE BEARING ASSEMBLY MACHINE

The bearing "needles" are put in one hopper, the cups in another hopper — and the machine automatically delivers assembled and greased bearings down the chute at the rate of 900 an hour! This is the latest, and most ingenious, development in a long line of needle bearing assembly machines . . . the design and manufacture of which has been a Rehnberg-Jacobson specialty for many years.



BEARINGS FOR UNIVERSAL JOINTS

The cup-type bearing shown here is mounted on the four journals of the "cross" of a well-known make of universal joint. The cup hopper, with its special one-way selecting device, is of R-J manufacture. The machine is mechanical and hydraulic in its functions, with electrical power and controls. *Let us discuss YOUR needle bearing assembly needs, and quote on your requirements.*



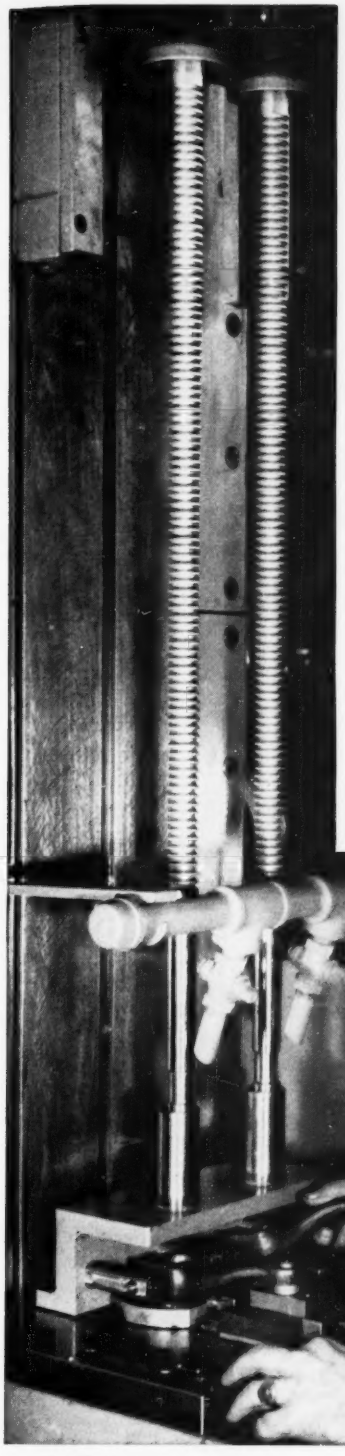
REHNBERG-JACOBSON MFG. COMPANY

DESIGNERS & BUILDERS OF SPECIAL MACHINERY

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS



CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**



THE *American* WAY...

TO PUT "TEETH" IN STEERING ARMS

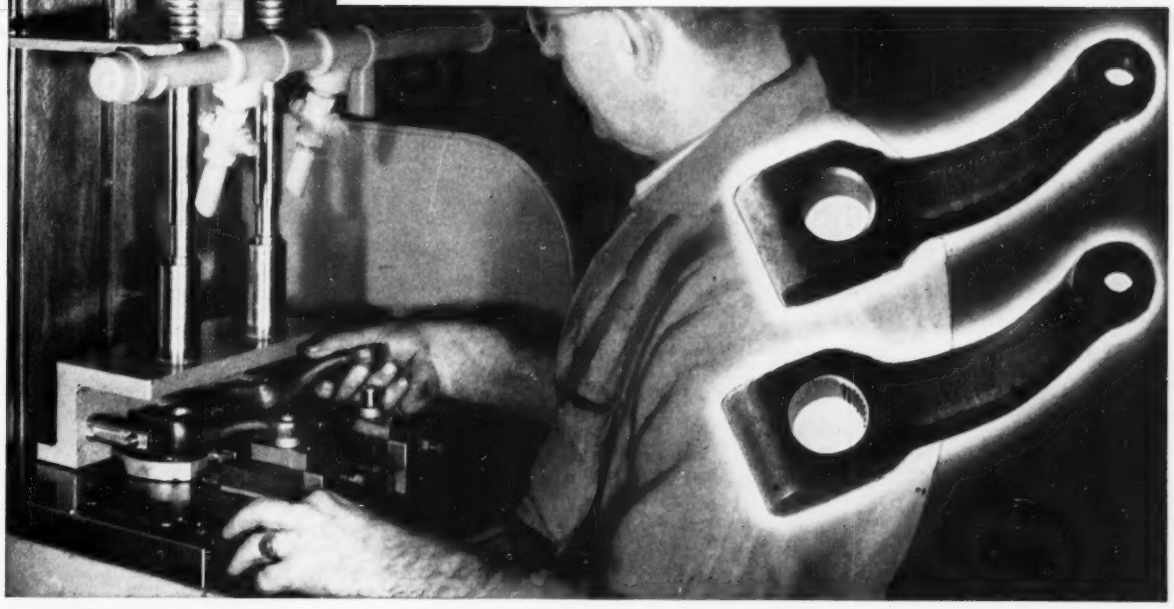
FASTER . . . AT LOWER COST

Two station fixture on a standard American broaching machine enables this manufacturer to broach 10 serrations in a segment of the steering arm hole and finish broach the hole in one pass. Location of the 10 serrations are maintained by index flats on the broach shanks. An economical, high-production rate of over 250 per hour was attained on an American T-10-36 vertical hydraulic broaching machine, with hydraulically operated, manually controlled broach retriever . . . arranged for two station pull-down broaching. The fixture holds one part at each station completing two parts at each stroke of the ram. Two hand manual control assures absolute operator safety.

Versatile Three-way Machines Achieve Overall Economy

Economical, high-production rates are easily attained on American type T, three-way broaching machines. Designed for inexpensive adaptation to push, pull or surface broaching, with single or multiple tooling of the ram, these three-way machines provide for low-cost conversion as production requirements change. American Engineers will be glad to make their recommendations for your broaching production. Write giving hourly requirements and part sample or drawing. Circular 100 gives full information on three-way machines. Address Dept. M.





AMERICAN *American* BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First—for the Best in Broaching Tools, Broaching Machines, Special Machinery

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



GREENLEE *Automatics*



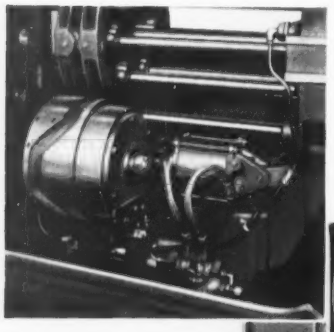
Close-up of the rear stock reel support, showing a piston (which follows and pushes the stock) being inserted in a stock tube. The air hoses are equipped with speed couplers.

AIR-FEED

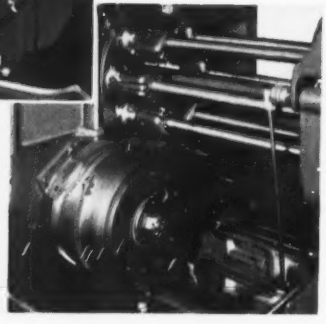
(PNEUMATIC STOCK FEED)

This method of feeding out stock was developed primarily for the many screw machine jobs that require either multiple feed-out arrangements, greater feed-out length than the conventional mechanical arrangement will permit, or for machining parts made from ground stock where pusher marks would be objectionable. It can be adapted to all 1" and 1⅝" GREENLEE Automatics.

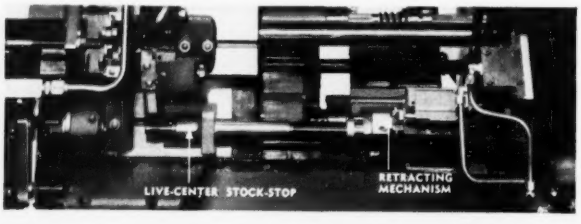
- FEEDS OUT STOCK TO 16½"
- PROVIDES MULTIPLE FEED-OUT
- ELIMINATES STOCK SCORING
- REDUCES STOCK REEL NOISE
- ELIMINATES STOCK PUSHERS
- ELIMINATES FEED-OUT CAMS



Left: One method of opening and closing the collets for multiple feed-out. The air cylinder, controlled by a plate cam on the cam drum, actuates the collet-operating rings. Various arrangements can be made, depending on the requirements of the particular job being set up.



Right: Simplification of the feed cam drum possible with air feed, where the collets are to be opened by the conventional mechanical arrangement between the 6th and 1st positions. Feed-out is usually against a standard fixed stop stock in such cases.



Above: A method used for feeding out stock during the machining cycle. The stock is fed out against an adjustable live-center stock-stop arrangement. When the collet jaws are closed, the live-center retracts and permits the stock to rotate freely and index to the next position.

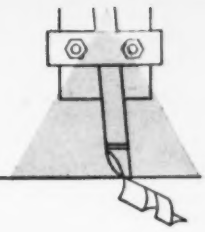
Write for Free Literature

GREENLEE

GREENLEE BROS. & CO., 1868 MASON AVE., ROCKFORD, ILL.

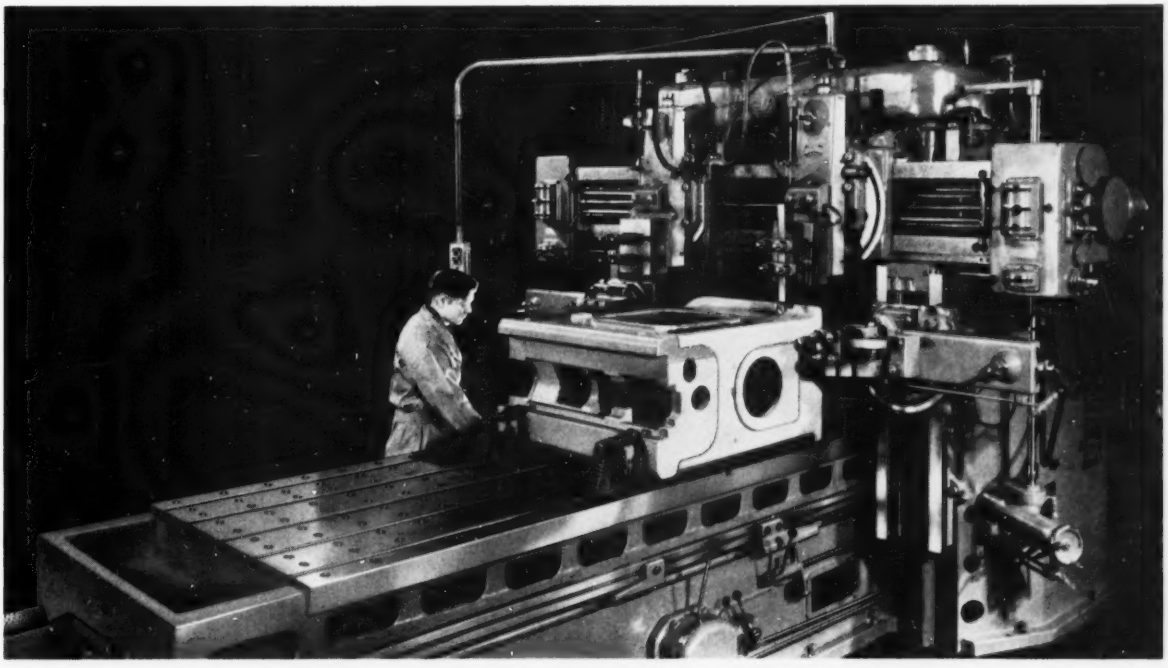


CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**



a cost cut . . . with every stroke of rockford hydraulic-driven

planers



higher production is obtained with every stroke **because...**

the great new Triple Circuit offers the correct combination of cutting speed and force to most economically machine materials from the free-cutting types to the toughest steel.

Send us your Planing specifications. Ask for full details of the Triple Circuit planing efficiency.

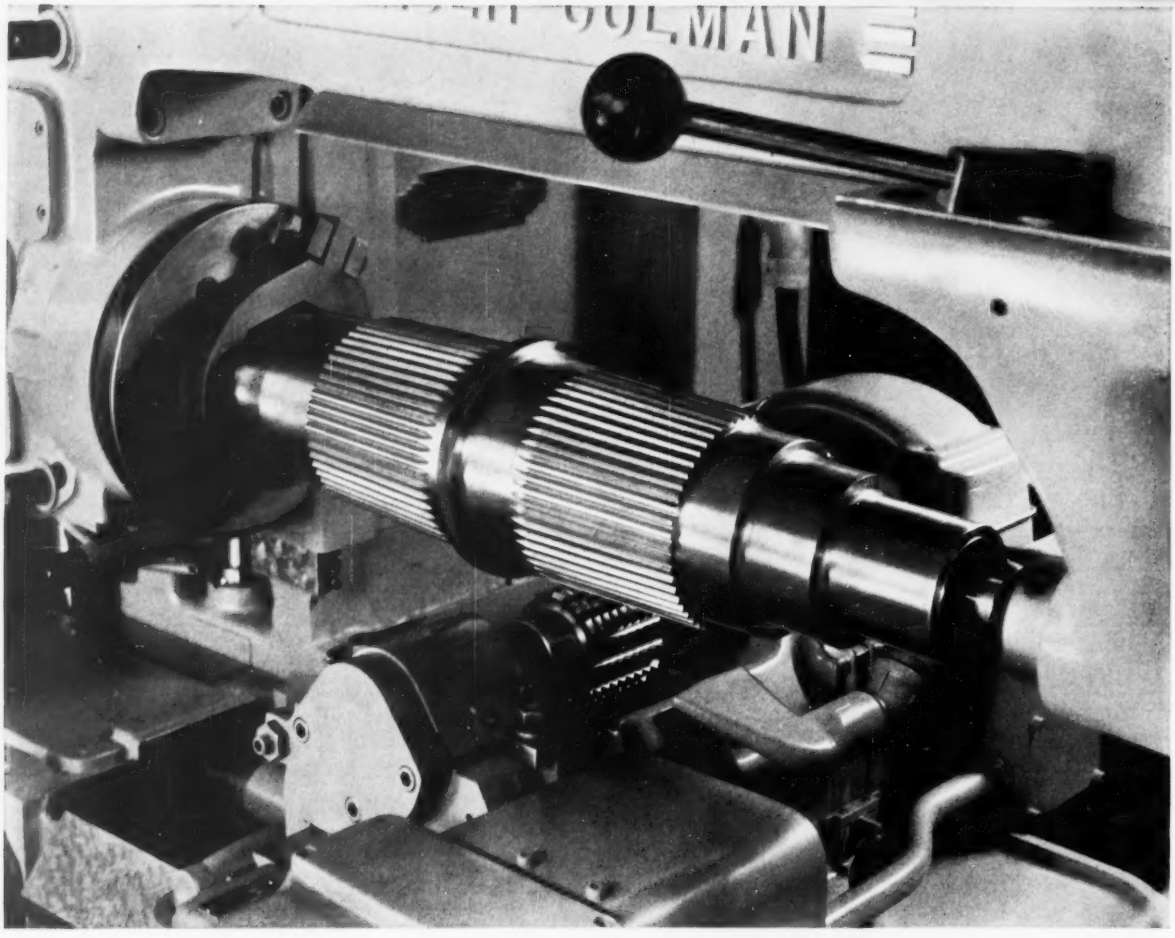
OUR 52nd YEAR

ROCKFORD MACHINE TOOL CO.

2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

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HEAVY TORSIONAL DRIVE USES TAPERED SERRATIONS

Hobbed On Specially Arranged Machines

work slide and overarm swivel up to 5°

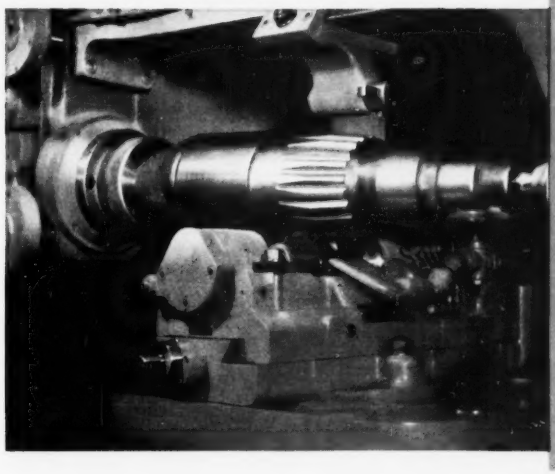
This Barber-Colman No. 16-16 Hobbing Machine is specially designed and arranged for hobbing tapered serrations. By swivelling the work slide up to 5° to obtain the desired cutting angle, several different tapers may be hobbed on the same machine. Once the proper set-up has been made, hobbing of tapered serrations proceeds according to standard hobbing technique.

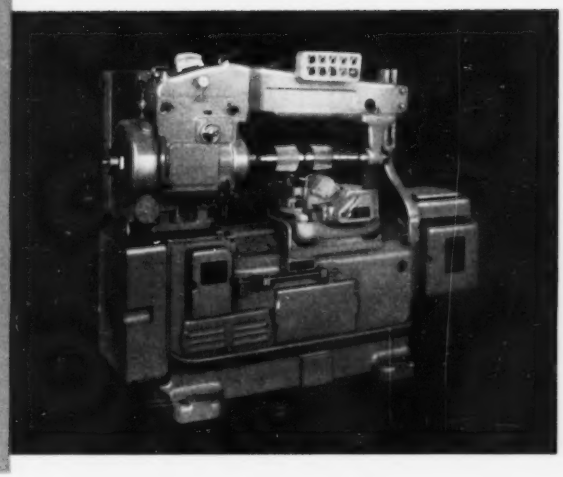
Other than the special swivel arrangement on the work slide, universal joint on the worm shaft, and a cut-away outboard overarm support, this machine is of standard design and illustrates the practicability of adapting special work to standard hobbing techniques.

When not in use hobbing tapered serrations, this machine can be used for standard spur or helical gear work and straight splines. It is equipped with an Automatic Hob Shifter for maximum hob life.

BUILDERS OF PRECISION GEAR

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**





metal-to-metal fit, wear compensation

Tapered serrations provide one of the best holding means for drives which have heavy and frequently-reversing torsional loads. The metal-to-metal side bearing fit eliminates relative rotation between members, and the taper provides for take-up to compensate for wear. Typical applications are heavy reversible drives such as tractor axles and hubs, and high-frequency reversible drives such as steering shafts and Pitman arms.

involute tapered serrations

Both involute and straight-sided tapered serrations may be produced by this hobbing method. The major illustration shows the hobbing of 10/20 diametral pitch involute serrations, ¾" taper per foot O.D., 54 teeth, and 6" major diameter. These teeth have a generated form with tapered root and outside diameter, the form changing continuously from the large to the small end. The mating part is swaged slightly undersize and the desired contact is obtained as a result of cold working the material in fitting the members. The swage is usually hobbed by the same set-up as the tapered shaft.

straight-sided tapered serrations

The second illustration shows the hobbing of straight-sided serrations using a single-position hob. These teeth are hobbed in 2-cuts and have straight sides with constant-width tooth spaces which permits the mating part to be broached to size after reaming to the correct taper. The internal mating part is broached one tooth at a time, providing a metal-to-metal fit which is not dependent upon cold working the material. Should looseness occur due to wear, it is taken-up on the tapered sides of the teeth.

Barber-Colman Engineers developed the special single-position hob for producing tapered serrations with a constant space width. They welcome special applications where this type of drive is an advantage and will be glad to furnish estimates on both hobs and machines for economically producing tapered serrations. Just send prints or samples marked for the attention of our Hob Engineers.

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 621 ROCK STREET, ROCKFORD, ILLINOIS

HOBS AND MACHINES SINCE 1911

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



INGERSOLL

SOLID SHANK CUTTERS



Ingersoll 8" dia. NX Solid Shank Cutter takes a cut 5" wide and 2½" deep in a 350 Brinell steel die block.

These action pictures show the exceptional performance of Ingersoll Solid Shank Cutters in milling hard, tough metal.

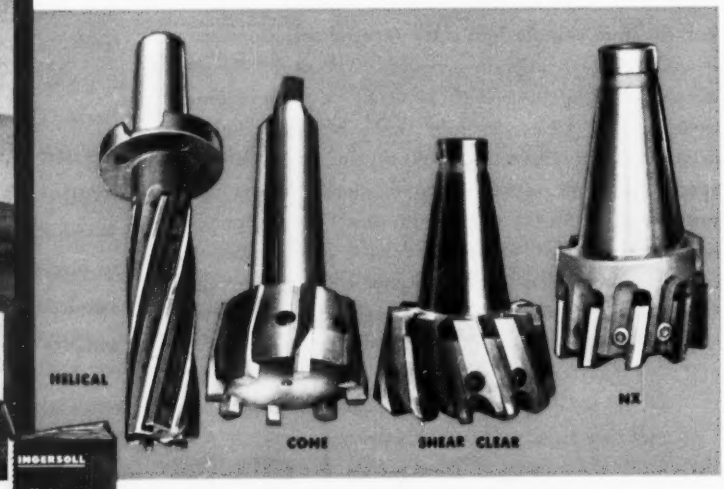
Developed by Ingersoll, with 65 years of experience in building special machines and milling cutters, these Solid Shank Cutters are made to handle difficult operations better because:

- Eliminating the center bore gives greater integral strength and stability . . . increases the capacity to absorb and transmit cutting power.
- Greater rigidity means uniform cutting by all blades, increased accuracy, faster feed rates and better finish.
- Solid shank design makes available the economies of inserted blades, even in cutters as small as 2" in diameter.

Ingersoll cutter engineers are available to recommend standard cutting tools that are designed for your particular work and which will give you excellent milling results. All Ingersoll cutters are manufactured with carbide-tipped, cast alloy or high speed steel replaceable blades.



This 4½" dia. Solid Shank Helical Cutter removes ¾" of tough cast iron along a strip 4" wide, feeding 12" per minute.





Write for Catalog 608, describing Ingersoll inserted blade face mills, end mills, helical slab mills, side mills, arbor cutters, angular cutters and boring heads.

THE INGERSOLL MILLING MACHINE COMPANY
ROCKFORD, ILLINOIS, U.S.A.

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES
ORIGINATORS OF SHEAR CLEAR CUTTERS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**



Mattison Grinder beats old time (15 hours) by 12 hours

The picture above shows a punch and die grinding operation on a Mattison High-Powered Precision Surface Grinder at Lyon Metal Products, Incorporated. Previous time on a converted planer-grinder was 15 hours — now with a Mattison Grinder equipped with special fixture, grinding time has been reduced to 3 hours.

Mattison Grinders are proving profitable investments in plants where "time out" for reconditioning is a vital factor in meeting production schedules. Surfaces are reconditioned and edges sharpened in a minimum of time, eliminating costly delays and holdup of production. Many manufacturers installing the Mattison Grinder for reconditioning dies find many other uses for it in grinding flat surfaces where accuracy and fine finish are required. For complete information on the Mattison High-Powered Precision Surface Grinder, send for free copy of our latest circular.

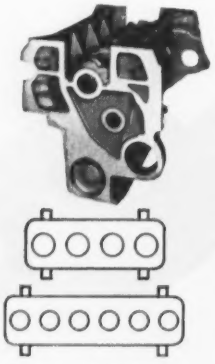
MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

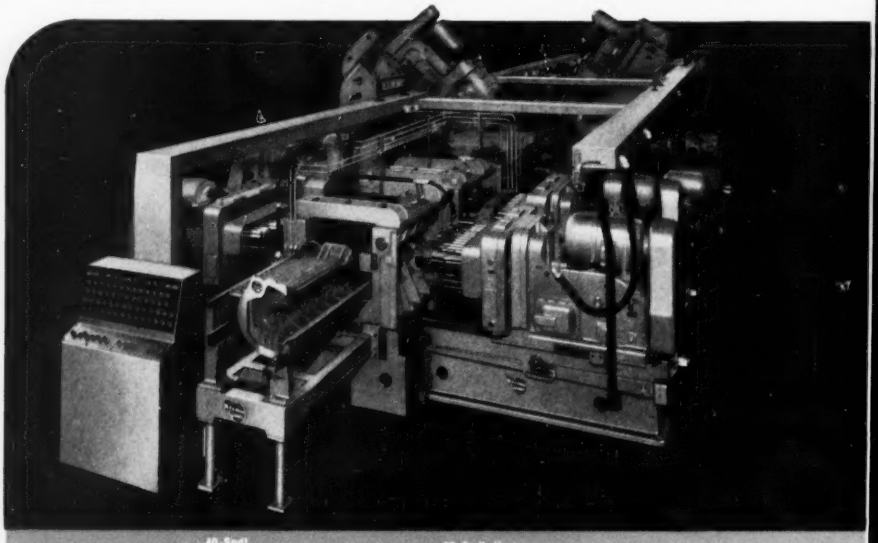


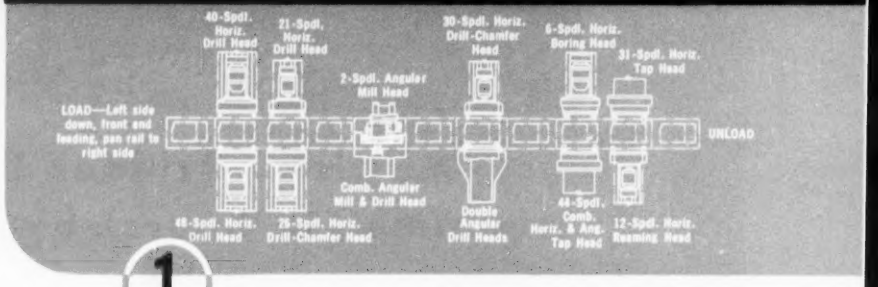
DUAL-PURPOSE SPECIALS

● Here's another outstanding example of how W. F. & John Barnes Coordinated Creative Engineering and Manufacturing Service has helped cut production costs . . . this time for a well-known farm equipment manufacturer. These three special machines have been ingeniously designed to machine TWO SIZES of tractor engine blocks . . . double-duty performance that not only means a lower original investment, but also simplifies tooling, reduces floor space requirements, and increases over-all production efficiency. Careful planning of tooling and machine components holds change-over time to a minimum . . . in fact,



Both 4 and 6-cylinder blocks are processed on the same Barnes' Special Machines.





1 Barnes 11-Station Progress-Thru Machine completes drilling, tapping, and milling operations on the 4 and 6-Cylinder Diesel Engine Blocks. Bushing plates, guide rails, head stops, transfer pusher fingers, and other machine components are quickly adjustable to handle both block sizes.

SAVE TIME WITH BARNES' COORDINATED 6-POINT BUILDING SERVICE

"Shopping around" is often a costly, time-consuming task, and all too often the results are disappointing . . . that's why Barnes offer a complete machine tool building service from *one convenient source* . . . it saves time and cuts costs because all the work is coordinated in one plant. Barnes' service includes:

1. **SPECIALIZED MANUFACTURING FACILITIES**—75-year background, large well equipped plant efficiently tooled to build high production machines.
2. **SPECIAL HYDRAULIC EQUIPMENT**—designed and built to meet JIC standards. Individually engineered units assure smooth, dependable actuation for every requirement.
3. **SPECIAL ELECTRICAL EQUIPMENT and CONTROLS** — individually designed and built for maximum safety and ease of control, with circuits that assure the most dependable coordination of all machine functions.
4. **SPECIAL GAUGES, FIXTURES, TOOLS**—designed for each individual machining problem, assure accuracy of operations at high production speeds.
5. **SPECIAL HANDLING AND CONVEYOR EQUIPMENT**—designed and built to reduce work handling, effect maximum safety and efficiency.
6. **COORDINATED DESIGN AND ENGINEERING**—Mechanical, Hydraulic, Electrical, Process, Tool, and Fixture Engineers work together at Barnes. Team-work solves complex problems quickly.

W. F. & JOHN BARNES

Builders of Better Machines Since 1872

Multiple Spindle Drilling • Boring



CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

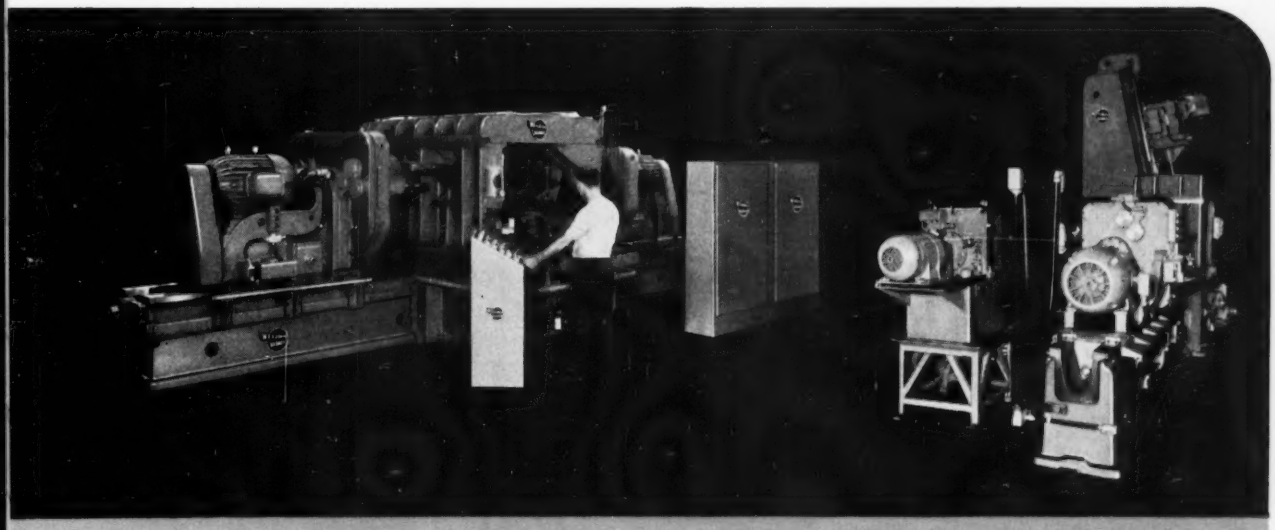
MACHINE BOTH 4 AND 6 CYLINDER ENGINE BLOCKS

much of the tooling is common to both block sizes and does not require changing. Bushing plates, guide rails, head stops, and transfer pusher fingers quickly and easily adjust to accommodate for variations in the two block designs. Where tooling changes are required, easy accessibility and quick conversion and set-up features speed the change-over.

OVER 75 YEARS OF MACHINE TOOL BUILDING EXPERIENCE

This unusual application is only one of many produced by Barnes . . . the result of over 75 years of accumulated knowledge in the highly specialized machine tool field. Creative skills, plus complete and extensive building facilities, assure you of machines possessing maximum capability for lowering production costs and improving product quality.

ASK FOR AN ANALYSIS OF YOUR PRODUCTION METHODS . . . YOUR PROBLEMS WILL RECEIVE EXPERT AND INDIVIDUAL ATTENTION





2 **Barnes Special 4-Station Progress-Thru Machine completes drilling, boring, and reaming on the blocks. Here again, adjustable features are built in to compensate for the two block sizes. Electrical interlocks on these machines prevent accidental tool damage during change-over. Idle stations are included for future tapping operations.**

3 **Special 3-Way Cam and Crank Boring Machine precision bores both block sizes. Adjustment features are similar to the preceding machines. All units are electrically controlled for automatic cycle sequence with push-button operation.**

Write Today **FOR YOUR COPY**
of "Coordinated Machine Engineering"—a 32-page booklet of automation equipment ideas.



W. F. & JOHN BARNES COMPANY
310 SOUTH WATER STREET, ROCKFORD, ILLINOIS
Tapping Machines • Automatic Progress-Thru and Transfer Type Machines



CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

precision Size Control • high Production

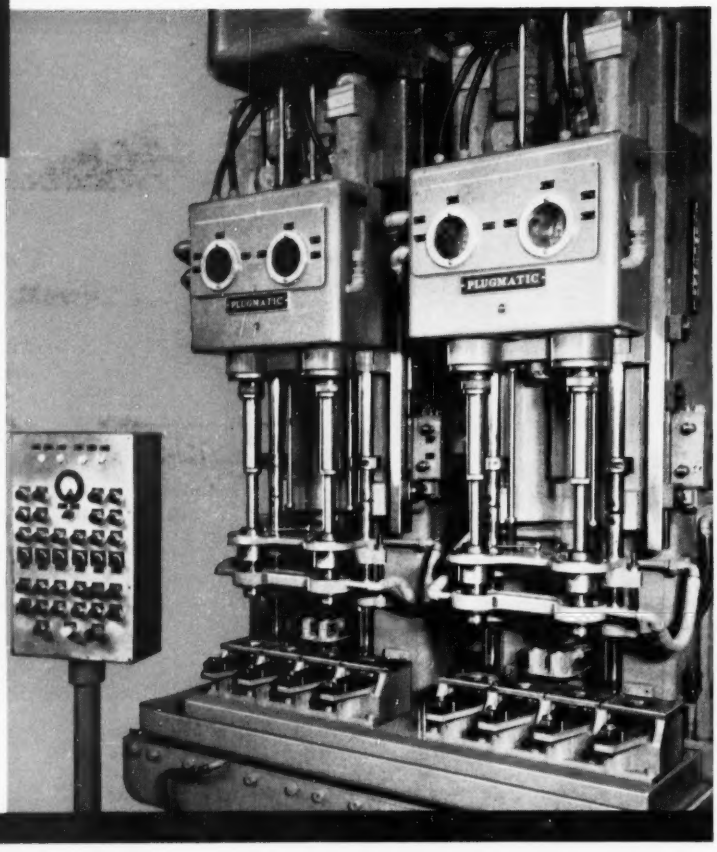
HONING CONNECTING RODS



with

BARNESDRIL

Plugmatic Bore-To-Bore Sizing
Electronic Hone Expansion
Extra Deep Stones



Greater Precision

Plugmatic gauging members size the work being honed. Are self-aligning and are *not affected* by *misalignment* or *eccentric stone wear.*

High Production

Automatic electronic control of hone expansion and compensation for stone wear keeps honing operation at peak efficiency. Extra-deep quick-loading stones provide longer abrasive life . . . quicker stone changes . . . less machine down-time.

Selected Finish

With electronic hone expansion control, the finish is accurately determined by the selection of the proper rate of feed and grit, grade and bond of abrasive stones.

Increased Stone Life

"Extra-deep" Plas-T-Clad stones provide more usable abrasive . . . positive support closer to the cutting edge . . . and freer cutting action.



Write or phone for a Barnesdril honing engineer to assist you with any honing problem. Ask for Bulletin No. 500.

SPECIFICATION DATA

Bore: 2.1247" — 2.1252" x 29/32"
Automatically sized bore-to-bore: within .0005"
Geometric Accuracy: within .0003"
Production: 540 rods per hour
Finish: 20 to 30 R.M.S.

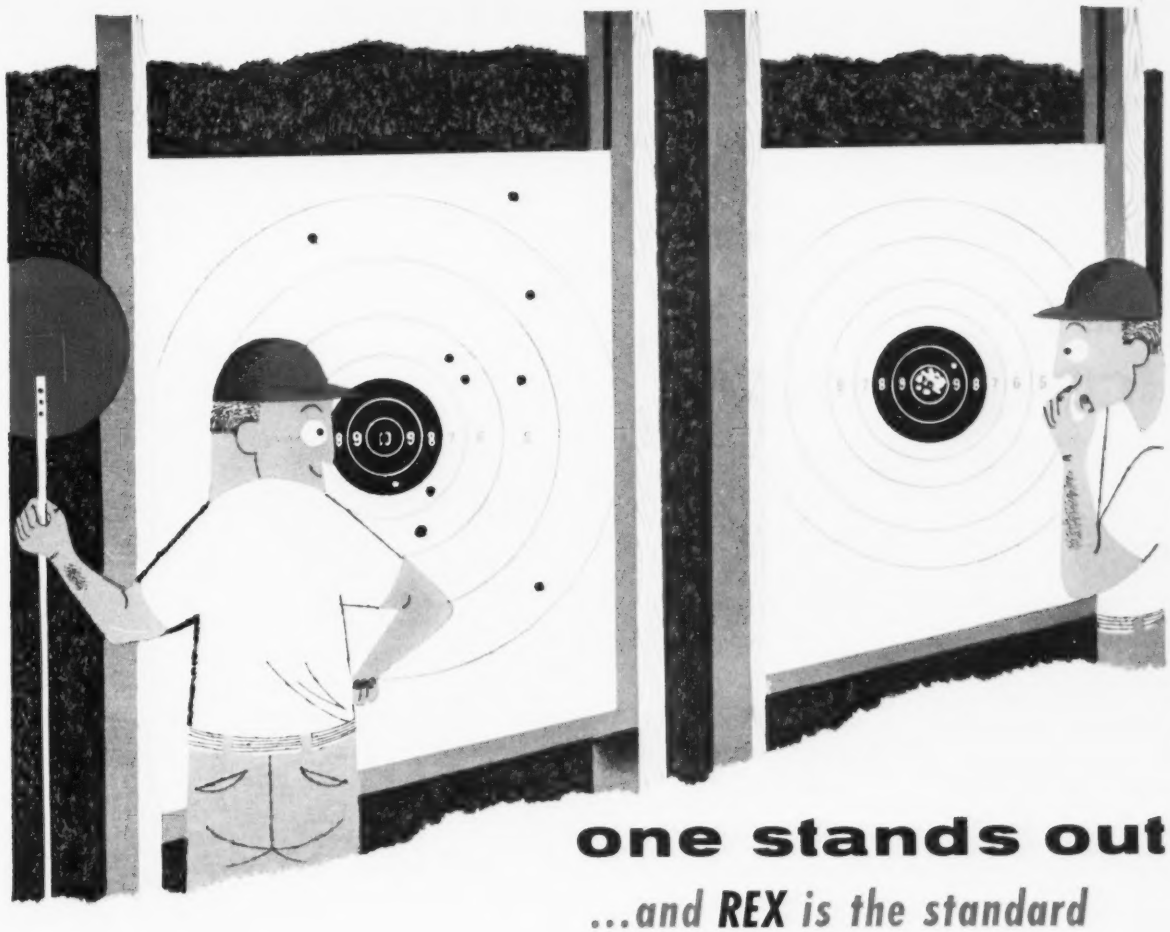
HOLE BARNESDRIL FINISHING

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS



MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



one stands out

...and REX is the standard by which all high speed steels are compared

It takes exceptional skill *and* experience to make consistent scores on the target range . . . or to produce consistently superior high speed steels.

Crucible has been making REX® High Speed Steels for over half a century . . . and REX is still the standard of comparison wherever high speed steels are used. That's no idle claim . . . and you can prove REX's superiority for yourself by putting a piece to work in your own shop. You'll like its hardenability, response to heat treatment, and good tool performance.

Once you've tried it, we think you'll agree — *you can't find a high speed steel that will outperform REX.*



CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **TOOL STEELS**

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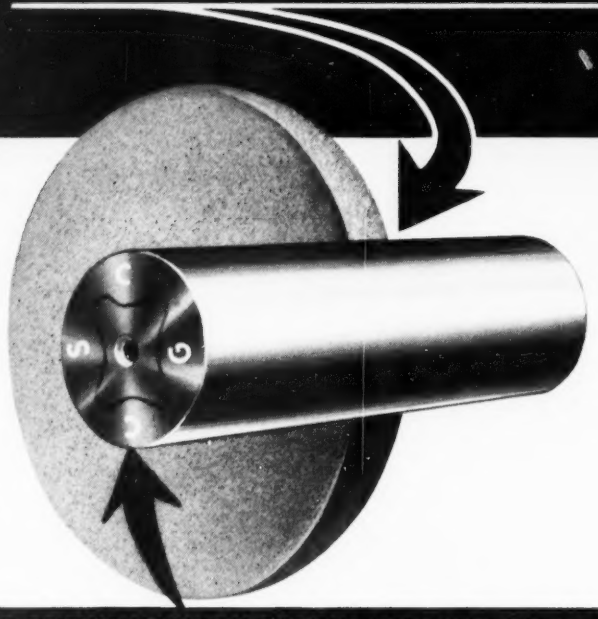
An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight,

smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

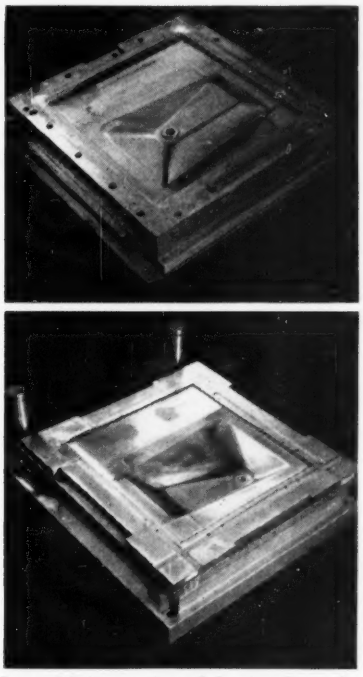
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Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



Top and bottom sections of drawing die, made of BTR, which was used in manufacture of the water-fountain top illustrated at right.

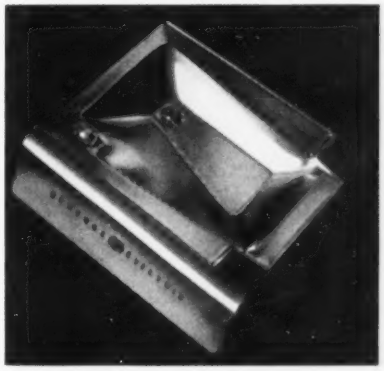
Die Draws 25,000 Stainless Pieces Without Showing Any Wear

The oblong section shown at right, a stainless-steel top for an electric water fountain, is one of a vast array of interesting specialty products being turned out by L. F. Grammes & Sons, Inc., Allentown, Pa.

To manufacture this part economically, engineers at the Grammes plant required a die having good wear-resistance, low distortion and good resistance to shock. What's more, they also wanted a tool steel that was both easy to machine and heat-treat.

BTR (Bethlehem Tool Room) was selected for the drawing die, which was hardened to Rockwell C-60 before being put to work in a 200-ton press. It's been giving a good account of itself, too. At last report, some 25,000 water-fountain tops had been produced, without any sign of die-wear.

BTR is a tough steel, with outstanding resistance to abrasion. You'll find it ideal in every way for many intricate tool-and-die applications.



BTR is our general purpose type of oil-hardening tool steel, and has this typical analysis:

Carbon	0.90	Chromium	0.50
Manganese	1.20	Vanadium	0.20
		Tungsten	0.50

BETHLEHEM TOOL STEEL ENGINEER SAYS:

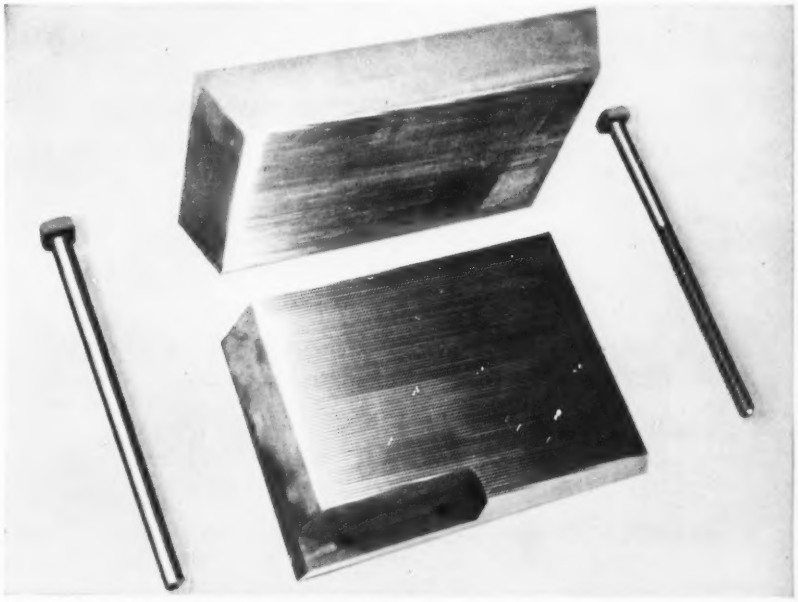


Don't Overlook the Interrupted Quench

One hears such a lot these days about isothermal annealing, martempering, automatic heat-treatment furnaces and a host of other modern processes that it is easy to overlook some of the old-time procedures which are still useful. For example, the interrupted quench.

An interrupted quench involves quenching a tool in water, then removing it from the water before the hardening transformation has started, and finishing the quench in oil. The tools should be removed from the oil while still warm, and should be tempered immediately. On water-hardening steels, an interrupted quench permits hardening of intricate sections which might crack if water-quenched all the way.

With oil-hardening steels, the interrupted quench permits hardening of sections which are too large to harden properly if oil-quenched all the way. At the same time this practice avoids the cracking which might possibly occur if a straight water quench were used.



THREAD-ROLLER DIES MADE OF LEHIGH H. These thread-roller dies, used in the manufacture of machine bolts, are made of Lehigh H, our air-hardening type of high-carbon, high-chromium tool steel. They have a Rockwell C hardness of 58-60. Lehigh H is resistant to wear, and has exceptionally high compressive strength, enabling threads to be cold-rolled on thousands of pieces before redressing is required.

The delivery you want ?



HE has it !

CAN I BUY it ready-made? How long will it take to get it here? Availability and proximity are the parents of prompt delivery, and they live in the house of your industrial distributor. Bunting Bronze Bearings and Bars are among countless items immediately procurable from industrial distributors all over America.

YOUR BUNTING distributor is the leading industrial distributor, or a stock-carrying specialist in certain industrial items. With money-saving convenience, he can supply hundreds of different sizes of completely machined and finished Bunting Standard Stock Industrial Bearings, Electric Motor Bearings and Precision Bronze Bars.

Ask him for a Bunting Catalog which gives complete dimensional and technical data.

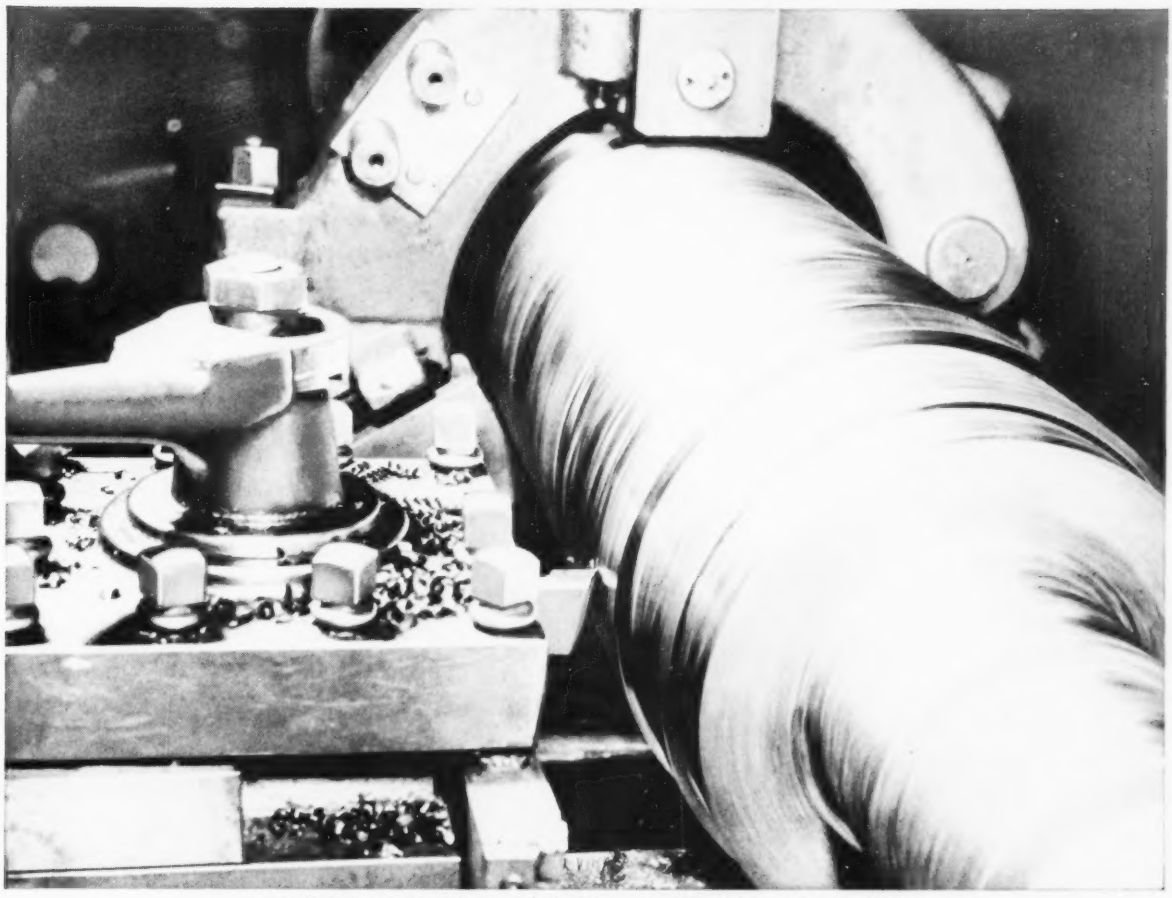


Bunting®

BRONZE BEARINGS • BUSHINGS • PRECISION BRONZE BARS

The Bunting Brass & Bronze Company • Toledo 1, Ohio • Branches in Principal Cities • Distributors Everywhere

For more information on products advertised, use Inquiry Card, page 241



Turning AISI 1045 modified (hot-rolled) steel, Grade 350 increased tool life, cut downtime, lowered unit costs.

CARBOLOY ANNOUNCES NEW GRADE 350 CARBIDE FOR LIGHT ROUGHING, GENERAL FINISHING OF STEEL

On-the-job tests show that Grade 350 cuts faster, lasts longer than existing carbides; boosts production up to 30%

Carboloy® Grade 350—the second of the new Series 300 steel-cutting carbides—combines superior wear resistance and extreme toughness to an extent never before possible in the light roughing and general finishing range of steel machining. This has been proved on exhaustive on-the-job customer tests and applications (photos, operating data on following pages). Grade 350 is outperforming all existing carbides by up to 30% in this medium-duty range.

Built-in Tip Rigidity

A new, carefully controlled manufacturing process gives Grade 350 a unique grain structure and built-in structural rigidity. This rigidity enables Grade 350 to effectively resist the high temperatures (around 1300° F.) encountered during high-speed machining . . . conditions which cause the cutting edges of other carbides to deform.

Two Steel-Cutting Grades Now Available

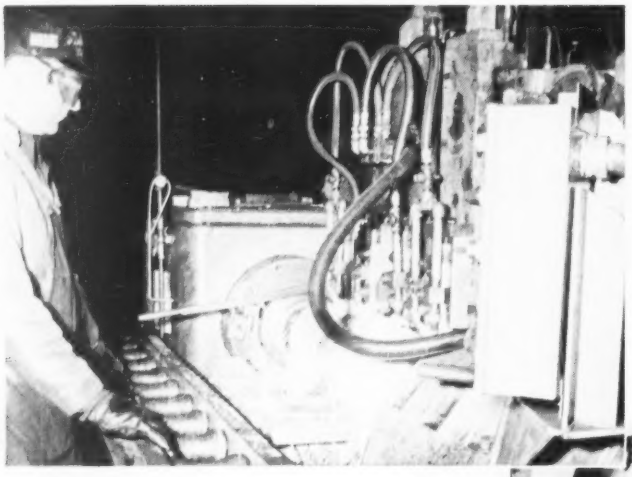
Grade 370 for heavy-duty steel cutting, introduced late in 1953, was the first of the new Carboloy Series 300 carbides. Now Grade 350 extends the machining range of this new series to medium-duty steel cutting. Both grades are available immediately in a wide range of Standard Carboloy Tools and blanks.

Typical in-plant case histories of these two new grades, with photos and operating data, are included on the following pages.

→

CARBOLOY GRADE 350 . . .

For light roughing and general finishing of steel

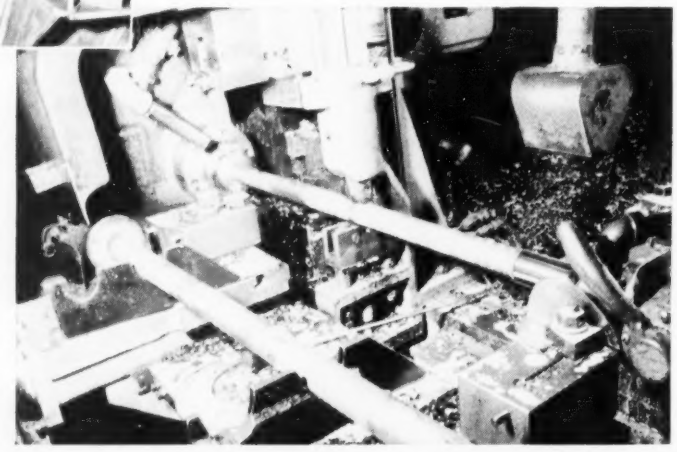


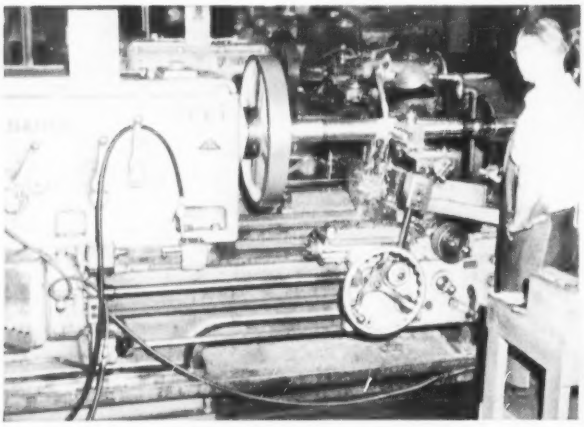
← **8-INCH STEEL SHELLS.** Grade 350 increased production runs on these forged and extruded shells between 15 and 20 pieces per grind. At toughest stage of rough-turning operation, Grade 350 processed 4 times as many shells as other carbides.

SETUP: Material—1045 steel with varying heat analysis. **Speed**—302 SFPM. **Feed**—0.044 inch. **Depth of cut**—$\frac{3}{16}$ to $\frac{7}{16}$ inch. **Coolant**—No.

TRUCK AXLE FORGING. Turning with Grade 350 resulted in 33⅓% more pieces per tool. Chipping and flaking, encountered with previously used tools, were eliminated. →

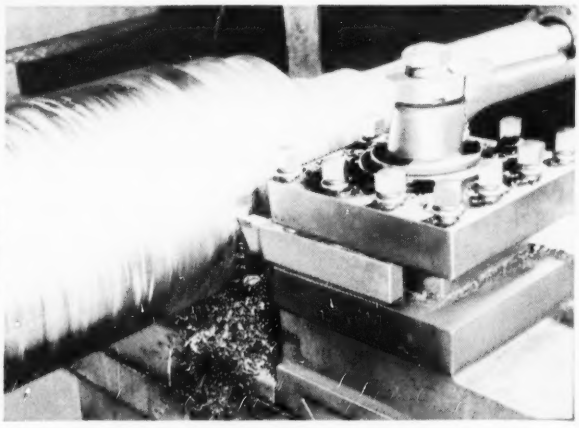
SETUP: Material—AISI 4150 steel forging. **Speed**—200 SFPM on 2-inch diameter; 400 SFPM on 1-inch diameter. **Feed**—0.014 inch. **Depth of cut**—$\frac{1}{16}$ to $\frac{1}{8}$ inch. **Coolant**—Yes.





LANDING GEAR PISTON. Other carbides produced 2 parts per grind at 125 SFPM at Menasco Mfg. Co. Grade 350 increased speed to 185 SFPM. Production per grind went up 6 times; downtime was cut ½ hour per shift.

SETUP: Material—1340 heat-treated forged steel. **Speed**—185 SFPM. **Feed**—0.010 inch. **Depth of cut**—0.060 to 0.200 inch. **Coolant**—Yes.

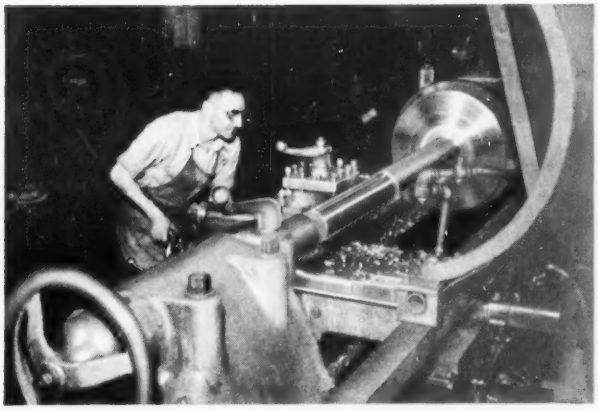


ELECTRIC MOTOR SHAFT. Carboloy Grade 350 increased the number of linear inches cut by 30% over other carbides used for roughing and finishing this large steel motor shaft.

SETUP: Material—AISI 1045 modified (hot-rolled). **Speed**—300 SFPM. **Feed**—0.020 inch. **Depth of cut**—$\frac{1}{16}$ to $\frac{1}{8}$ inch. **Coolant**—Yes.

CARBOLOY GRADE 370 . . .

For heavy-duty steel cutting at higher speeds



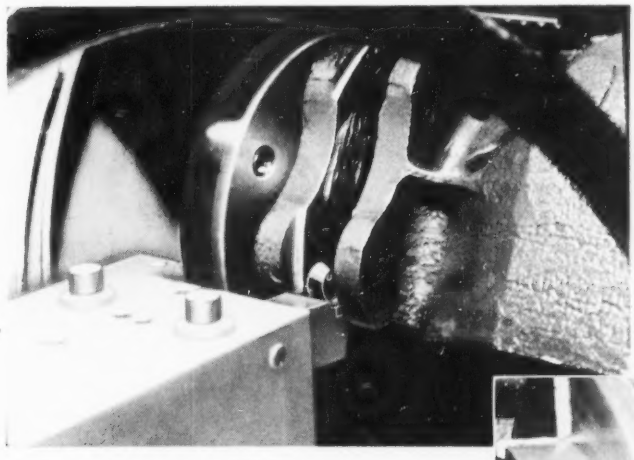
JET ENGINE TURBINE WHEEL SHAFT. A single Grade 370 tool now handles roughing and finishing at General Electric's Lynn River Works. Formerly, two tools were needed. Though operating at around 1700° F., Grade 370 increased tool life at least 10%.

SETUP: Material—4340 steel with Brinell hardness from 269 to 321. **Speed**—200 SFPM. **Feed**—0.013 inch. **Depth of cut**—$\frac{3}{16}$ to $\frac{5}{8}$ inch.



JET ENGINE TURBINE WHEEL RIMS. With Grade 370, G.E. got 300% increase in life of tools used for turning, boring and facing cold-worked Timken steel rims. Downtime was reduced two thirds and tool breakage drastically cut.

SETUP: Material—Cold-worked, forged Timken steel. **Speed**—160 SFPM on O.D.; 110 SFPM on I.D. **Feed**—0.010 inch. **Depth of cut**—$\frac{1}{2}$ to $\frac{5}{8}$ inch. **Coolant**—Yes.



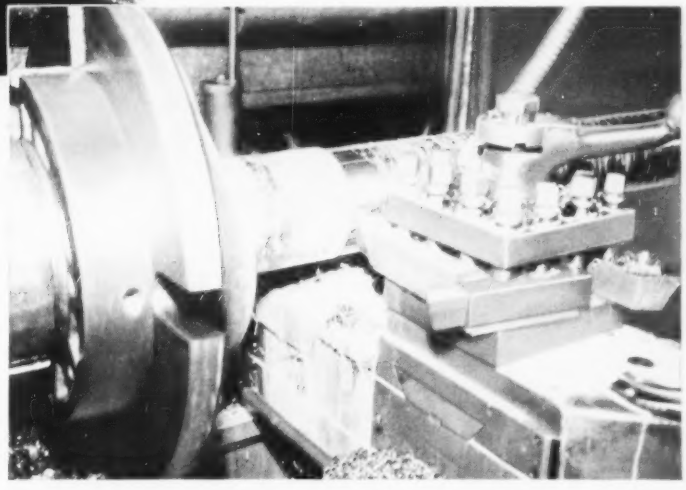
← **TRANSMISSION CASING** for fork lift truck. Machine downtime was sliced 50% and tool life extended almost 40% when Yale and Towne switched to Grade 370. Despite irregular steel casting, tool life on plunge facing operation increased 5 times with Grade 370.

SETUP: Material—Irregular cast steel with chilled spots and sand occlusions. **Speed**—318 SFPM. **Feed**—0.006 inch. **Depth of cut**—$\frac{1}{16}$ to $\frac{1}{2}$ inch. **Coolant**—No.

DRIVE ROLLER SHAFT. Use of Carboloy Grade 370 on this heavily scaled forging reduced machining time 25% at Thew Shovel Co., Lorain, Ohio. Tool life was increased almost 50% and cratering encountered with other tools was eliminated.

SETUP: Material—AISI 1035 hot-rolled forging. **Speed**—336 SFPM. **Feed**—0.025 inch. **Depth of cut**—$\frac{1}{2}$ inch.

→



Grades 350 and 370 now available in a wide range of standard tools and blanks

Many Standard Carboloy Tools are now tipped with Grades 350 and 370. In addition, blanks and inserts of each grade are available in several styles and in many sizes.

Your Authorized Carboloy Distributor now has complete stocks of tools and blanks to fill most of your requirements. Other styles and sizes are available nonstock.

For more information on medium-duty Grade 350 and heavy-duty Grade 370, and for price lists and specifications, send coupon, today.

For light roughing and general finishing of steel

GRADE 350

STOCK ITEMS

Blanks—6 styles, 40 sizes

Tools—5 styles, 20 sizes

Other styles and sizes available nonstock

For heavy-duty steel cutting

GRADE 370

STOCK ITEMS

Blanks—6 styles, 55 sizes

Tools—9 styles, 26 sizes

Other styles and sizes available nonstock

CARBIDES FOR ALL YOUR MACHINING

In today's competitive economy, carbides can cut your unit production costs on machining all materials—ferrous or nonferrous, metallic or nonmetallic.

Standard Carboloy Tools and blanks in other grades suited for your job are available. Contact your local Carboloy Authorized Distributor or salesman for tooling assistance. Send coupon, today, for free, new Brief-A-Log (GT-280) containing complete specifications and new lower prices!

CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

CARBOLOY
Department of General Electric Company,
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☐ Send Price List GT-300, containing specifications and prices on new Grades 350 and 370

☐ Send new Brief-A-Log GT-280, containing specifications and prices on Standard Carboloy Tools and blanks in other grades

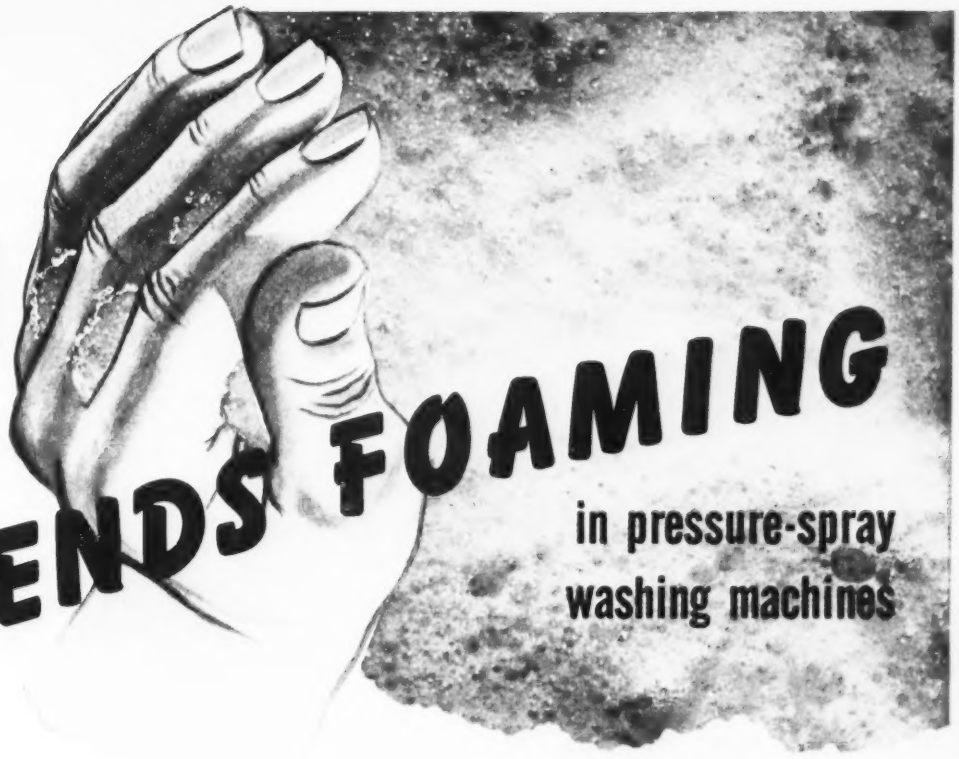
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Company_____

Address_____

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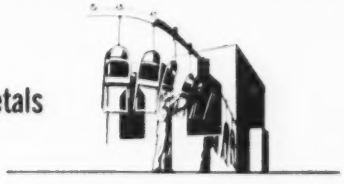
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NEW Cleaner ENDS FOAMING in pressure-spray washing machines

...it's NEW Oakite Composition No. 161 specially designed for washing aluminum

Long-lasting and safe
...good for steel, other metals



Here's your best answer for curbing foam in your power washers. Oakite Composition No. 161, specially designed for washing aluminum, removes all oils, identification inks, ordinary shop soils with great speed and efficiency. *Yet Oakite Composition No. 161 will not foam even when used at high pressures.*

Oakite Composition No. 161 is a SAFE cleaner. It's scientifically inhibited against attack on aluminum surfaces. It dissolves readily. Rinses freely.

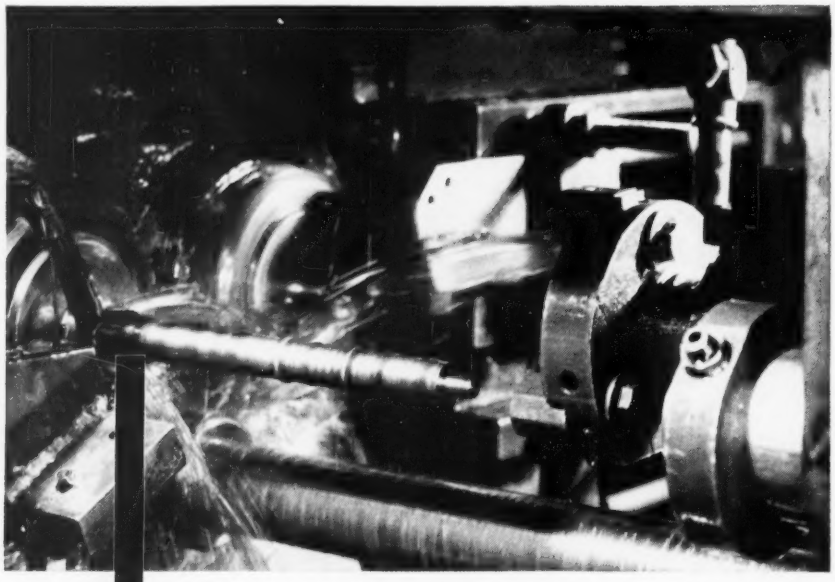
Oakite Composition No. 161 is also highly recommended for cleaning steel and other metals in high pressure spray-washing machines.

Try Oakite Composition No. 161 for improving metal-finishing results, fewer rejects, lower production costs. Complete details gladly mailed free on request. Ask for Special Service Report—B3201. Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

OAKITE

TRADE MARK REG. U.S. PAT. OFF.

Technical Service Representatives Located in Principal Cities of United States and Canada







How to make duplicate stainless steel parts economically

Make them out of ENDURO Stainless Steel Cold Drawn Bars. Then you get high production rates from your automatics, plus all the high physical and chemical properties you want from stainless steel.

Here's how one manufacturer does it: Edward Valves, Inc., East Chicago, Ind., makes a new MUDWONDER Valve used in the oil fields. It must have high resistance to corrosion and long life.

Valve stems are made of ENDURO Cold Drawn Types 410 and 416. And Edward methods engineers say they get good production for these reasons:

1. **High speeds and feeds can be used**
2. **Surface finish is excellent**
3. **Tool life is longer, down-time for re-grinding is less**

You can have these same advantages in your stainless steel parts, by specifying ENDURO Cold Drawn Bars. And Republic metallurgists will be glad to help you choose the right grades for best production on your present machines. Write to:

REPUBLIC STEEL CORPORATION
Alloy Steel Division • *Massillon, Ohio*
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REPUBLIC ENDURO
FREE-MACHINING STAINLESS STEEL

REPUBLIC STEEL

Other Republic Products include Carbon and Alloy Steels — Titanium — Pipe, Sheets, Strip, Bars, Wire, Pig Iron, Bolts and Nuts, Tubing

For more information on products advertised, use Inquiry Card, page 241



LUDLUM TOOL STEELS are *clearly* marked ...you can't mix up grades in your stock



For Production Men Only

"TOOL STEEL HANDBOOK"

We say "production men only" because this is a *work* book, not a picture book. It's a case-bound volume of 196 pages, packed full of technical data on the analyses, uses, handling and shop treatment of all grades of A-L Tool and Die Steels. Sent free, but ask for it on your company letterhead, please.

Address Dept. M-56

"What's *that* piece?" . . . "Are you *sure?*" . . . In anybody's toolroom or stock racks, the best inventory or material identification system is apt to go haywire once in a while—and sometimes with grievous results.

But not when you're using tool steel grades produced by A-L! Each length of Ludlum Tool Steel is clearly marked with its grade name every few inches the entire length of the bar—*stenciled* in such a manner that the marking stays bright and clear, and can't be blurred or wiped off in handling.

Even a small crop end on a machine bench is readily identifiable—you can't go wrong. And that's only a small part of the benefit you can realize by using Ludlum Tool Steels—available from stocks coast to coast. Let our Metallurgical Service go to bat on some of your tougher tool steel problems. ***Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.***

For complete **MODERN** Tooling, call

Allegheny Ludlum

AL FINE TOOL STEELS SINCE 1854

WHY IT PAYS TO BUY COLD FINISHED BARS FROM US



• Our experienced technical staff will help you determine what grade of cold finished bar would best help cut costs in *your* shop. Often, you can realize great savings by not over-buying quality . . . the best bar for the job is *not* necessarily the most expensive.

The large, ready-to-deliver stocks in all our warehouses include a wide variety of types in the sizes and shapes most commonly used. These cold finished bars are produced under exacting quality control by the world's foremost steel manufacturer—United States Steel.

When you want the best in cold finished bars, combined with sound technical assistance and prompt delivery, call your nearest U. S. Steel Supply warehouse. We carry: cold finished rounds, squares, hexagons, flats and precision shafting in all grades; cold finished screw stock, Bessemer rounds, "MX" high speed screw stock.

TRIPLE SECURITY

What you want
When you want it
At the **right price**

U. S. STEEL SUPPLY
DIVISION

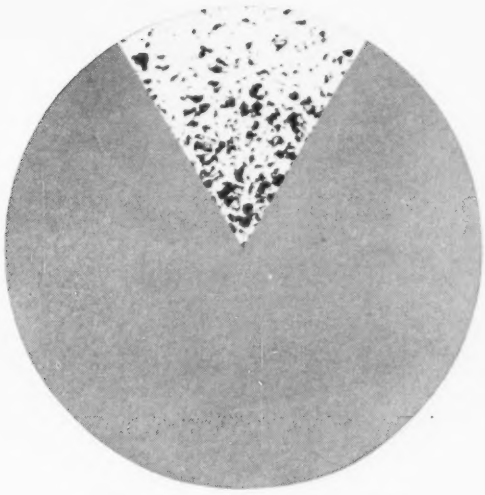
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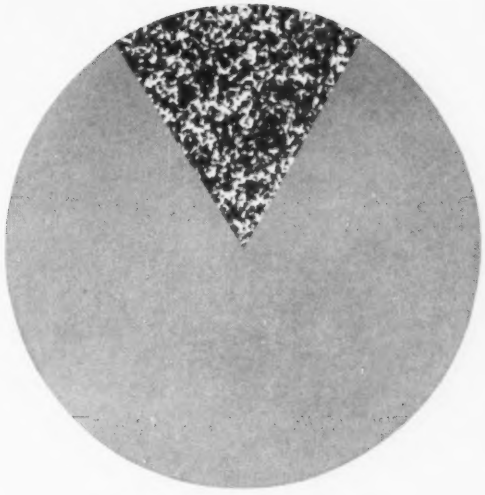
USS STEEL
UNITED STATES STEEL

UNITED STATES STEEL

For more information on products advertised, use Inquiry Card, page 241



Photomicrograph showing "decarb" to a depth of .020" in the surface of a hot rolled bar of C-1050 steel—magnified 100 times.



Same bar after carbon correction annealing. Note the restoration of carbon on outer surface, also the refinement of grain structure.

Republic Cold Drawn Carbon Corrected Bars CUT YOUR UNIT COSTS 3 WAYS

1. You eliminate waste, both metal and money. It's not necessary to machine or grind away the surface of Republic Union Carbon Corrected Bars to remove "decarb."
2. You eliminate buying bars oversize to allow for surface removal.
3. You get better MACHINABILITY.

Carbon correction is the restoration of carbon lost from the bar surface during hot rolling. This lost carbon is restored right out to the edge of the bar through annealing in a controlled carbon-rich atmosphere prior to cold drawing. Carbon Corrected Bars are ideally suited for your steel parts which must have high surface hardness—particularly those produced by both high and low frequency induction heating.

Our metallurgists and machining engineers are ready to help you use Republic Cold Drawn Carbon Corrected Bars to the best advantage. They are ready to help you get high production efficiency, low unit cost and better machinability.

Call your Union Drawn Distributor or your nearest Republic District Sales Office.

REPUBLIC UNION COLD DRAWN SPECIAL SECTIONS

Buy your steel parts by the foot and save money. These bars are cold drawn to the predominating cross-section of the part. Often, cutting to length and drilling are the only operations necessary to finish the part. Send us samples or blueprints of your parts. We will show you how Republic Cold Drawn Special Sections can be applied to your product.

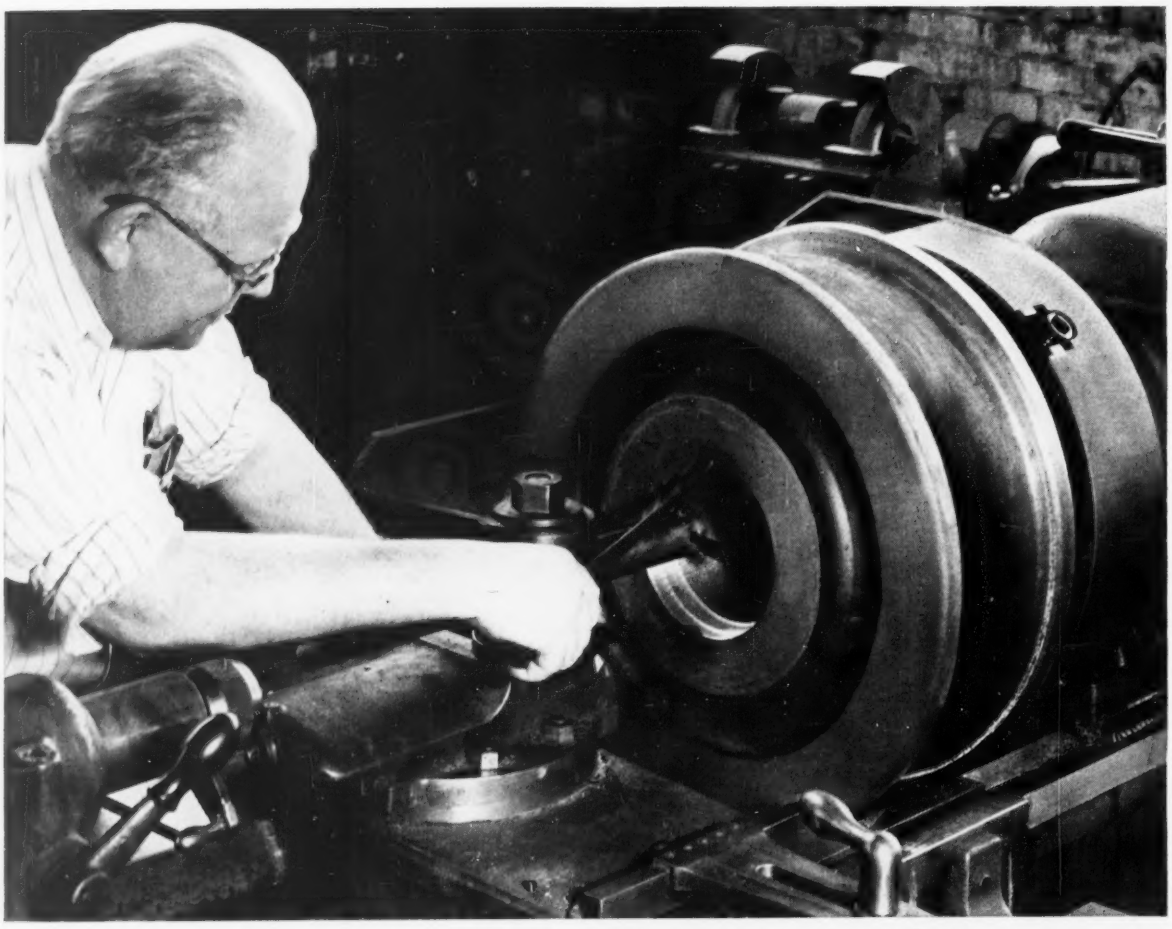
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Union Drawn Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

REPUBLIC *Union* COLD DRAWN STEELS

REPUBLIC STEEL

Free-Machining Bessemer, Alloy and Enduro Stainless Steels • Union Cold Drawn Special Sections
Union Cold Drawn and Ground Rounds, Turned and Polished Rounds, and Turned, Ground and Polished Rounds

For more information on products advertised, use Inquiry Card, page 241



Double-flanged wheel during machining at plant of Michigan Crane & Conveyor Company, Detroit.

The Number One Requirement Was Strength

That's a big, sturdy crane-track wheel in the photograph. It had to be strong to meet the top requirement of some very rigid specifications. In its original form, the wheel was a rough-machined blank, one of a number produced by Bethlehem's forging-and-rolling process for Michigan Crane & Conveyor Company.

Here the specifications called for double-flanged blanks of unusual ruggedness. Fast delivery was another consideration. Bethlehem blanks met all requirements in full, and delivery was made with plenty of time to spare. It was a good example of filling a customer's special needs in every detail, and filling them quickly.

Crane wheels, of course, are but one of the many uses for Bethlehem circular blanks. Available in a wide variety of sections, these sturdy steel blanks are produced by an exclusive process that combines the benefits of both forging and rolling. Their strength makes them entirely suitable for gears, sheave wheels, flywheels, turbine rotor wheels, and numerous other circular parts.

No doubt you could use such blanks to advantage in your own operations. We make them in a most convenient range of sizes—10 to 42 in. OD—and they can be furnished untreated or heat-treated, as specified. Call or write us for complete information.

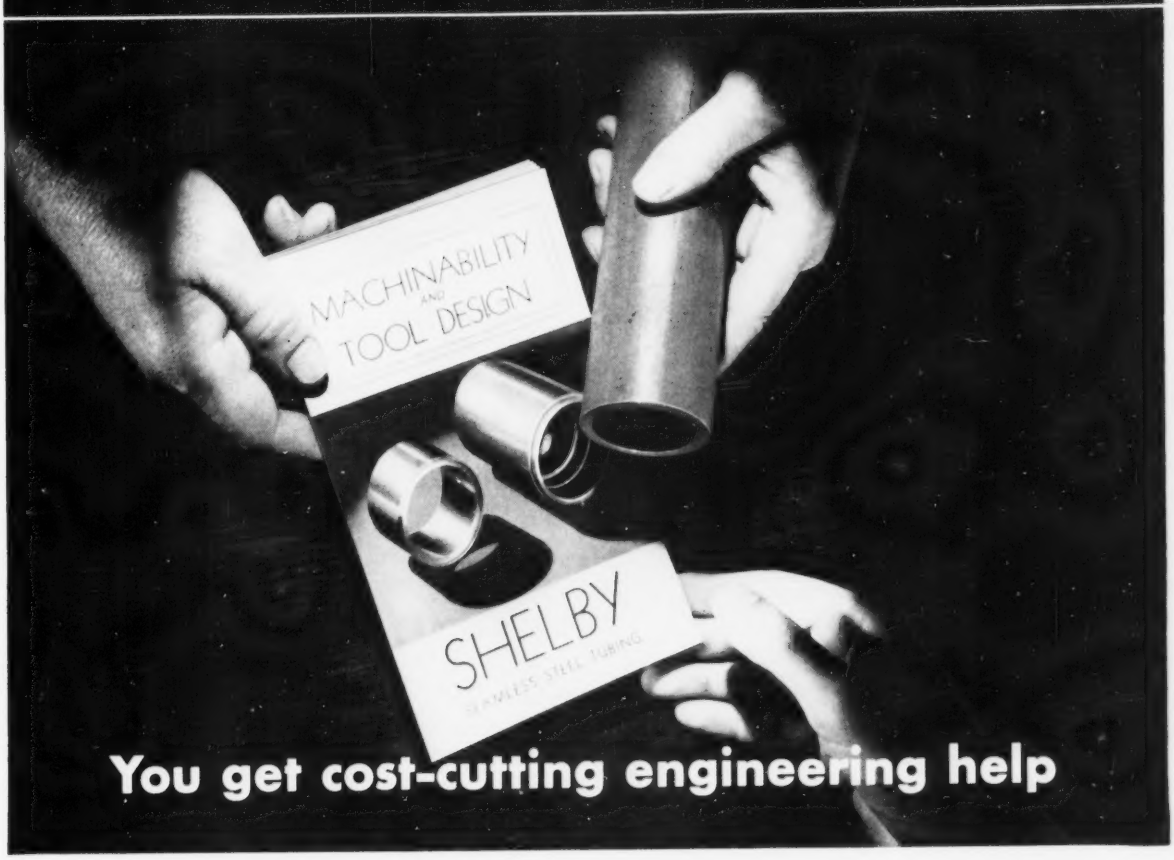


BETHLEHEM
Forged-and-Rolled
CIRCULAR FORGINGS

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

WHY IT PAYS TO BUY MECHANICAL TUBING FROM US



You get cost-cutting engineering help

● Our wide experience with all types of tubing problems has saved a lot of money for a lot of our customers. For example, we can often find a less costly type of tubing that will do a job as well or even better than a type that might cost more, but would not be "best" in that particular application.

You too may benefit from our accumulated "know-how." For no matter what type or size job you have, you can always depend upon us for thorough, up-to-date technical assistance.

And our more-than-complete tubing stocks—we carry 531 sizes of Shelby Seamless Tubing—means that you will get fast delivery of exactly the type you want. It's all top quality tubing too . . . manufactured by the National Tube Division of United States Steel.

So let *us* carry the costly, cumbersome tubing inventory that can meet your every requirement . . . competently, quickly. Call us when you need: mechanical tubing, round and square, seamless and welded; boiler tubing, pressure tubing and pipe; stainless steel tubing, seamless and welded, and stainless pipe.

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What you want
When you want it
At the **right price**

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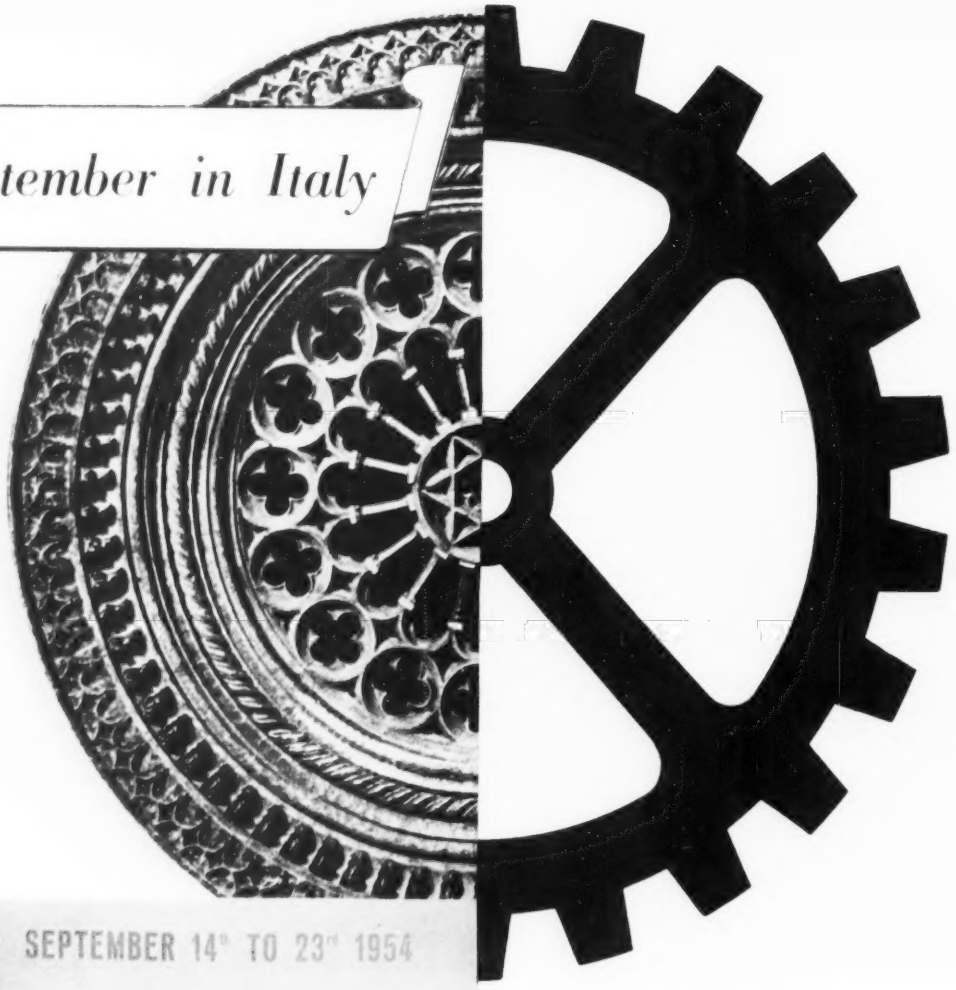
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UNITED STATES STEEL

UNITED STATES STEEL

September in Italy



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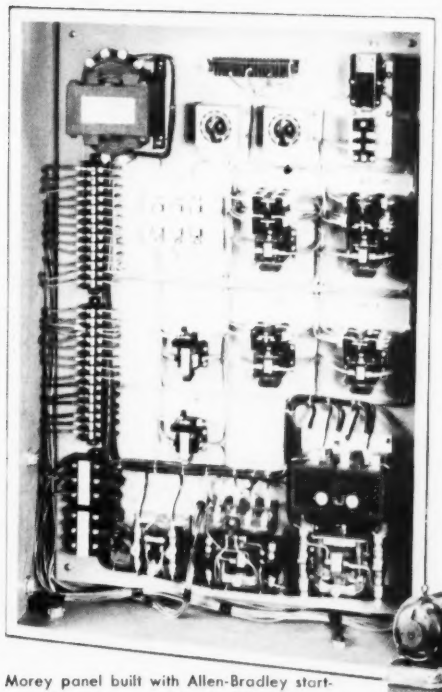
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Milano, Italy

Lodgings:

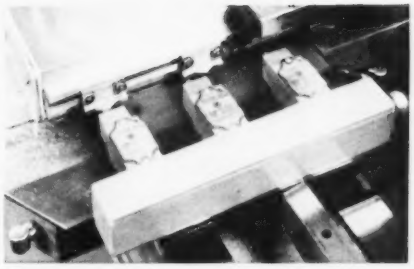
Ente Provinciale per il Turismo
Via Dogana 4, Milano
Telephone: 870016
Telegrams: Enturismo Milano



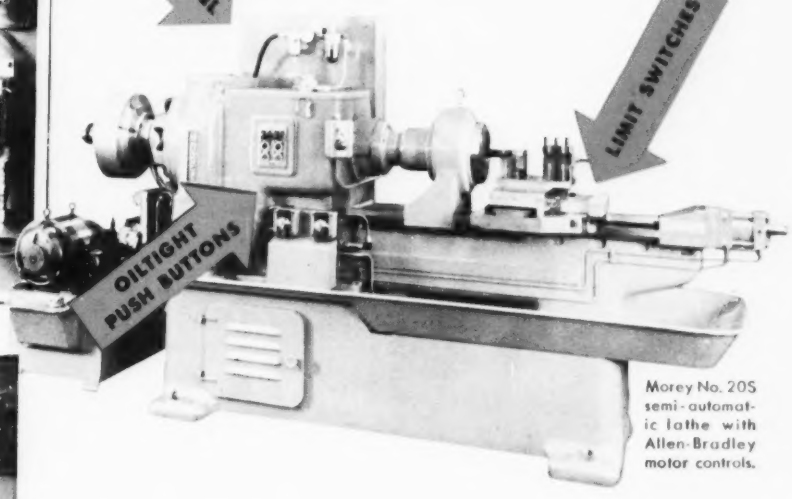
Morey panel built with Allen-Bradley starters, relays, timers, and terminal blocks.



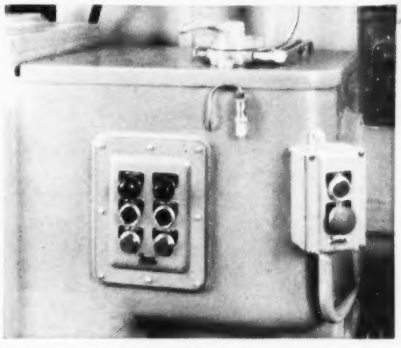
Bulletin 802T Type D oiltight limit switch.



Three Bulletin 802T oiltight limit switches on Morey semi-automatic lathe for limiting travel of tool holder.



Morey No. 20S semi-automatic lathe with Allen-Bradley motor controls.



Close-up of Bulletin 800T oiltight push buttons on Morey lathe. They control spindle and pump motors.

Add a Sales Asset to your Machine Tools by standardizing on A-B MOTOR CONTROLS

With the growing trend toward AUTOMATION, electric motor controls are items of critical interest to machinery buyers. They recognize the A-B trademark as a label of QUALITY for the Allen-Bradley starters, relays, contactors, timers, drums, limit switches, and push buttons. So, why not standardize on Allen-Bradley motor controls and enjoy the benefits of a prestige line of quality control units? It will not only assure reliable performance of your machines but add another touch of quality appearance . . . a distinct sales asset.

An Allen-Bradley sales engineer will gladly recommend the best combination of controls for the maximum output of your machines. Why not phone your nearest Allen-Bradley office, today?

Allen-Bradley Co., 1316 South Second St., Milwaukee 4, Wisconsin



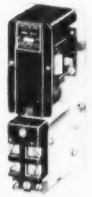
Bulletin 709 Size 2 solenoid starter.



Bulletin 709 Size 1 solenoid starter.



Bulletin 700 solenoid relay—Universal type.



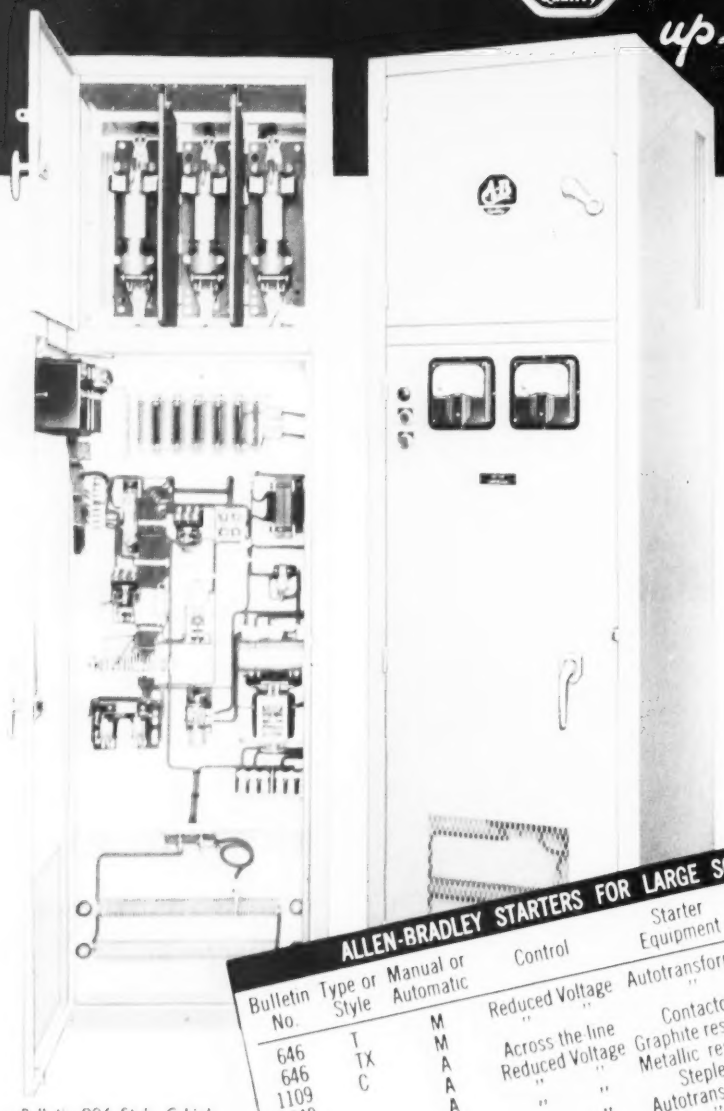
Bulletin 849 pneumatic timing relay.

ALLEN-BRADLEY
QUALITY
MOTOR CONTROL

A-B Quality

8-54 R

LIFETIME A-B STARTERS up to 1500 HP



Bulletin 906 Style C high voltage synchronous motor starter with current-limiting fuses. Self-protecting against short circuits up to 150,000 kva on 2500 volts or 250,000 kva on 2501 to 4600 v. The high tension, solenoid operated, across-the-line oil-immersed switch is mounted in oil tank behind the panel. Cabinet has hinged doors on front and back.

There are 14 different types of these rugged Allen-Bradley starters. (See listings below.) Some are of the across-the-line type . . . but most of them are reduced voltage starters using resistors, transformers, or reactors during the starting period.

These starters are available in 2500 to 4600 volt ratings for squirrel cage motors from 700 to 1250 hp, and for synchronous motors from 800 to 1500 hp. They are listed for squirrel cage motors from 125 hp, 220 v to 600 hp, 440-550 v, and for synchronous motors from 350 hp, 220 v to 700 hp, 440-550 v.

For complete details, please send for the A-B Handy Catalog.

ALLEN-BRADLEY STARTERS FOR LARGE SQUIRREL CAGE MOTORS

Bulletin No.	Type or Style	Manual or Automatic	Control	Starter Equipment	Maximum Horsepower at Rated Voltage 220V	440-550V	2000-2500V	2501-4600V
646	T	M	Reduced Voltage	Autotransformer	125	250	700	1250
646	TX	M	" "	"				
1109	C	A	Across the line	Contactor		200		
740		A	Reduced Voltage	Graphite resistors	200	200		
741		A	" "	Metallic resistors	300	600		
742		A	" "	Stepless	300	600		
746	CT	A	" "	Autotransformer	300	600	700	1250
1146								

ALLEN-BRADLEY STARTERS FOR LARGE SYNCHRONOUS MOTORS

Bulletin No.	Type or Style	Manual or Automatic	Control	Starter Equipment	Maximum Horsepower at Rated Voltage 220V	440-550V	2000-2500V	2501-4600V
906	A	A	Across the line	Contactor	350	700	800	1500
906	C	A	" " "	"				
914		A	Reduced Voltage	Resistors	250	250		
922	AT	A	" "	Autotransformer	350	700	800	1500
922	CT	A	" "	"			800	1500
922	CR	A	" "	Reactor				

8-54-R

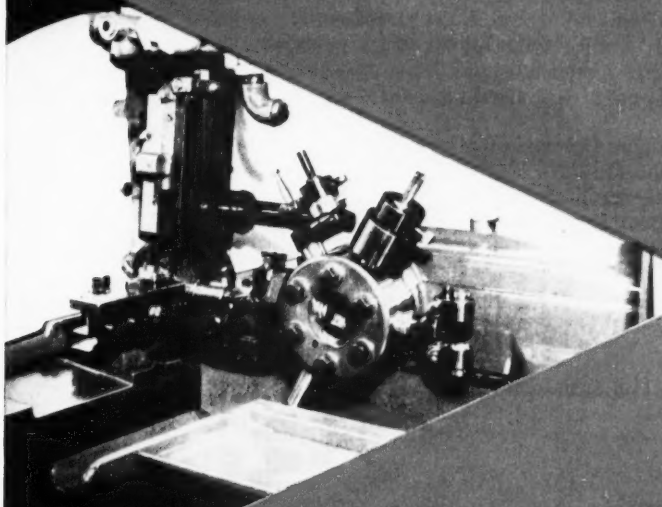
Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

ALLEN-BRADLEY
TROUBLE FREE MOTOR CONTROLS
QUALITY

PRECISION IS AS PRECISION DOES

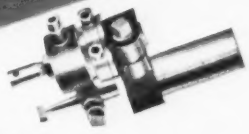
R AND L TOOLS

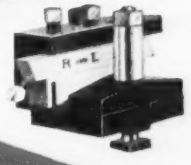
The Tools A Meticulous Machinist Would Design For Himself

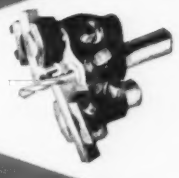












Faultlessly ground for accuracy and alignment at any point of adjustment, here are tools of toughest, heat treated, alloy steel . . . guaranteed not to bend or give way. R AND L TOOLS were developed in a machine shop . . . the culmination of over 45 years of experience and research . . . truly masterpieces of the tool maker's art.

R AND L TOOLS pay for themselves through reduced setting up time . . . speeding up production . . . lower operating costs!

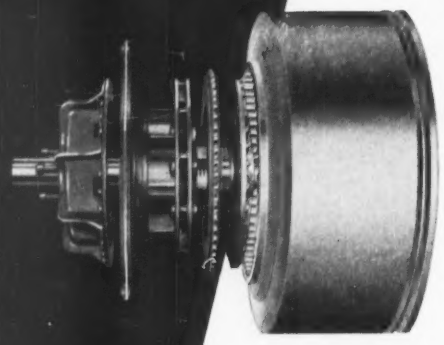
Write for Catalog

RIGHT R and L LEFT TOOLS

1825 BRISTOL STREET — PHILADELPHIA 40, PENNA.

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO FURNISHED FOR ACORN DIES) • UNIVERSAL TOOL POST • TURRET BACKREST HOLDER • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

Columbia
STEEL SQUARING SHEARS
up to 75% less gear wear
with the exclusive air clutch!



Exploded View of Air Operated Disc Clutch

. . . another Columbia exclusive. It eliminates unnecessary gear wear

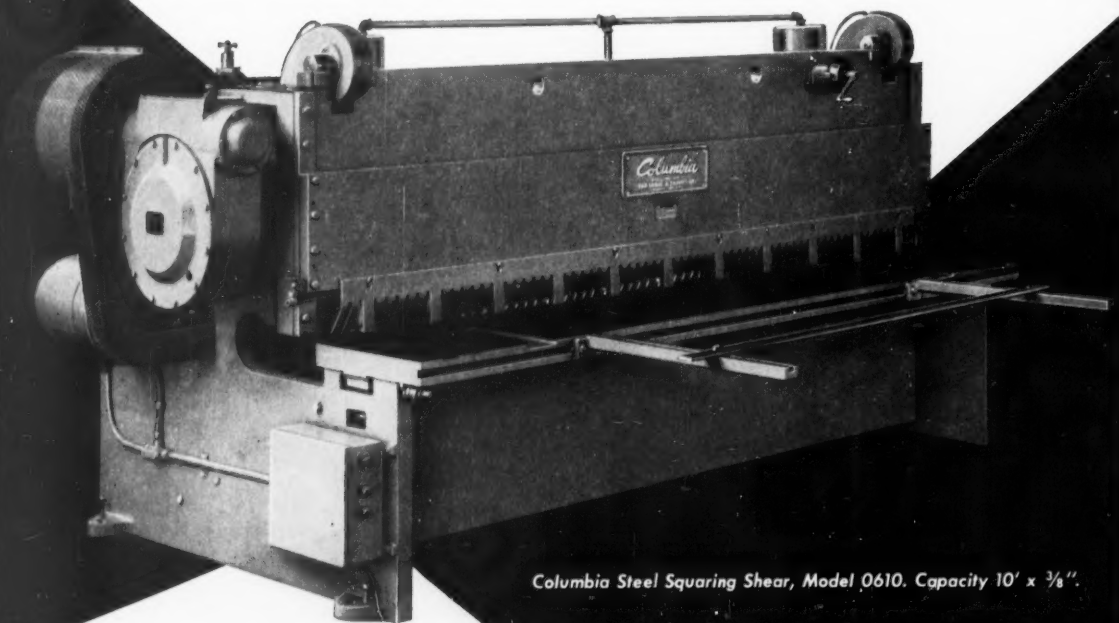
. . . gives never-failing overload protection

. . . cushions shock!

A cost-reducing, safety Air Clutch is one of the many exclusive, built-in Columbia "New Series" Shear features.

This air-operated clutch reduces gear wear as much as 75% since all gear movement is eliminated except in the actual cutting cycle. Inherent clutch slippage at the overload point protects machine and drive. Air-application of power is soft; shocks are not transmitted.

Other Columbia features you should know about include the exclusive Quick-Set Blade Clearance, Hydraulic Hold-downs, Jog Control for Ram Back Brace Adjustment, Air Counterbalances, Remote Foot Switch, and others. Together with basic ruggedness, rigidity and long-lasting accuracy these features mean that Columbia Shears offer more machine for the money!



Columbia Steel Squaring Shear, Model 0610. Capacity 10' x 3/8".

Other exclusive Columbia features are explained in detail in FREE Bulletin No. PS-2. Write for it and the name of your Columbia dealer, *today!*

COLUMBIA DIVISION, THE LODGE & SHIPLEY CO.
HAMILTON 1, OHIO

new series Columbia STEEL SQUARING SHEARS and POWER PRESS BRAKES

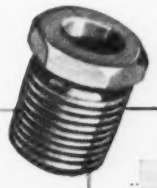
For more information on products advertised, use Inquiry Card, page 241

Conomatics demonstrate carbide tools

We believe you know that not every "automatic" job can be tooled successfully with 100% carbide. What we think you may not know is that the Conomatic Carbide Development program is making progress with such jobs. This relatively new Cone service is convincing to those who like to be shown that "it can be done".

Granted that experimental runs are not production runs, it has often been proved that under actual production conditions they have developed into production runs. A number of conditions must be met in the successful use of any tooling material. Carbide is no exception. If the comparisons of 100% carbide and HSS runs indicate as much gain as per the job illustrated, the reward is worth the effort.

For full particulars please consult your Cone Representative or inquire direct.

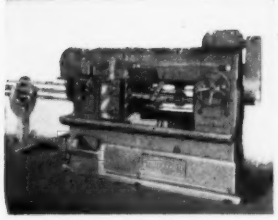


MATERIAL—EVERDURE: (96% copper, 3% silicon, 1% manganese) Hole drilled with 17/32" drill to 1½" depth; thread rolling of ½" pipe thread.

	HSS	CARBIDE
Cycle Time	35 secs.	15 secs.
Work Spindle Speed	420 R.P.M. at 124 S.F.	850 R.P.M. at 250 S.F.
Tool Wear	2000 pcs. per grind	5000 pcs. per grind



The CONOMATIC is the ONLY representative of Frame "A". The short, "weave-proof," upright members, secured between larger and heavier top bed and base, make possible the strongest type of bridged support to the tooling area and its "work and tool axis."

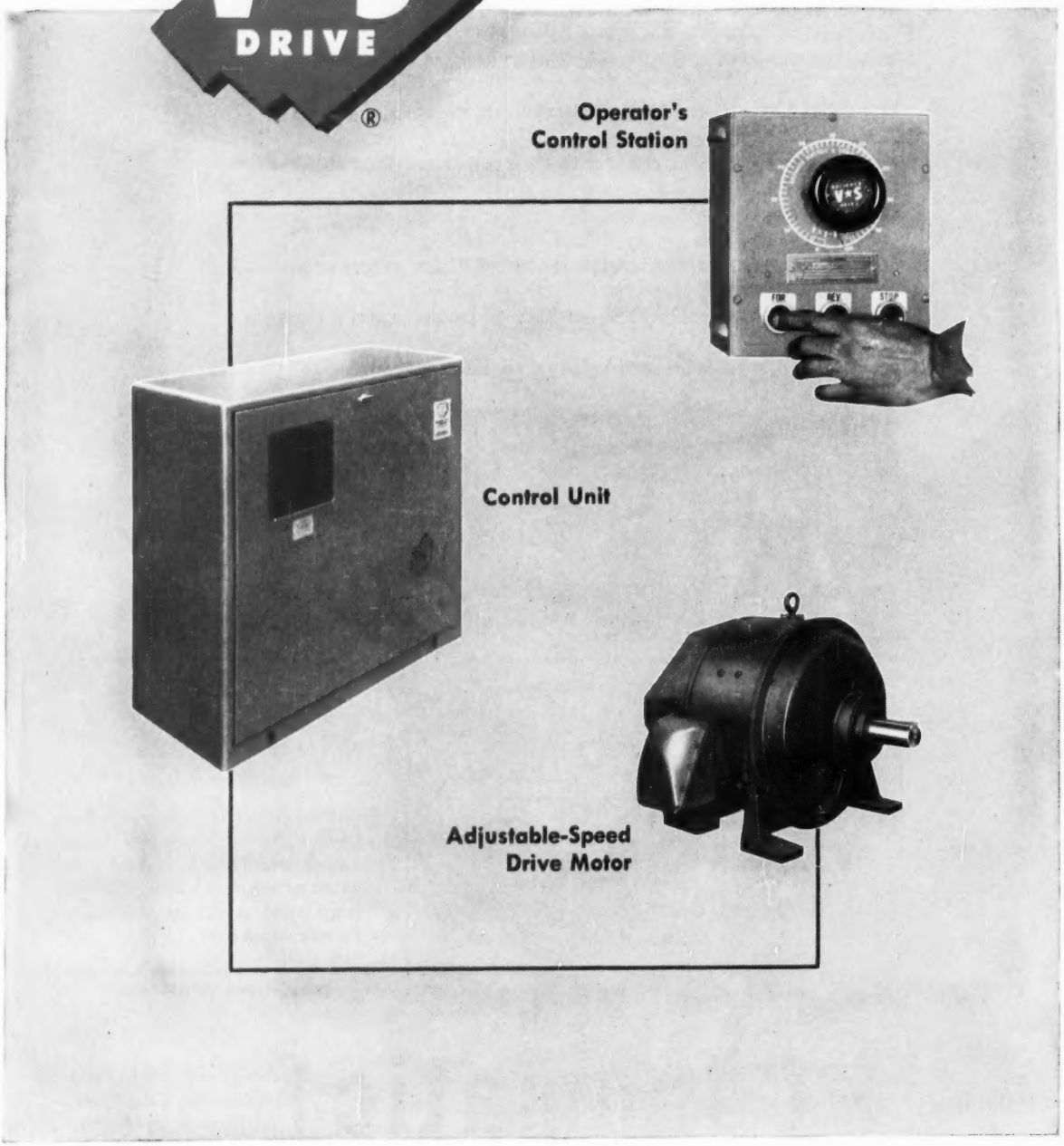


Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

BUILT AND APPLIED BY RELIANCE

THESE *Tools of Automation* INCREASE

RELIANCE V★S DRIVE ®



PRODUCTION OUTPUT IN EVERY INDUSTRY

moving things faster...more accurately!

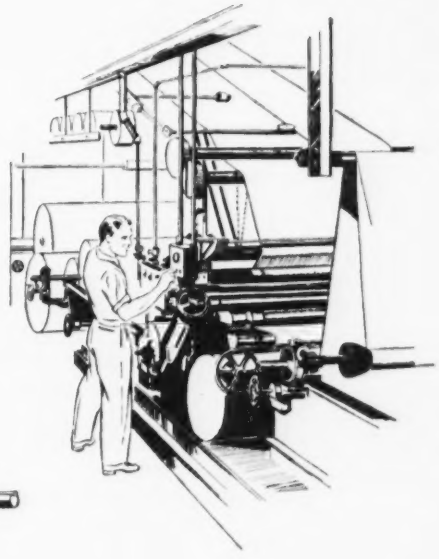
RELIANCE *Precision-Built* MOTORS

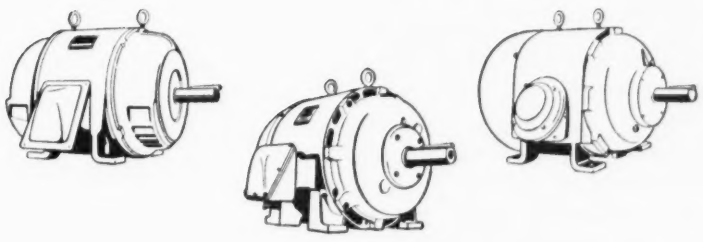
Reliance electric motors, adjustable-speed drives, electronic controls, and applied engineering—the Tools of Automation—make it possible to secure increased production in a single machine... part of a process... or an entire factory.

And these tools provide all the dependability and economy you need to get complete benefits of automated equipment. They have established an unequaled record of performance under the most exacting operating conditions in industries like textile, chemical, steel, metal working and automotive.

One of the most important Tools of Automation is Reliance Applied Engineering which is used to analyze and supply the answer to your specific situation. Reliance engineering is backed by nearly 50 years of experience in the development and engineering of drive systems which have made automation possible.

For all the facts, write for your copy of our new booklet, "The Tools of Automation". A-1471



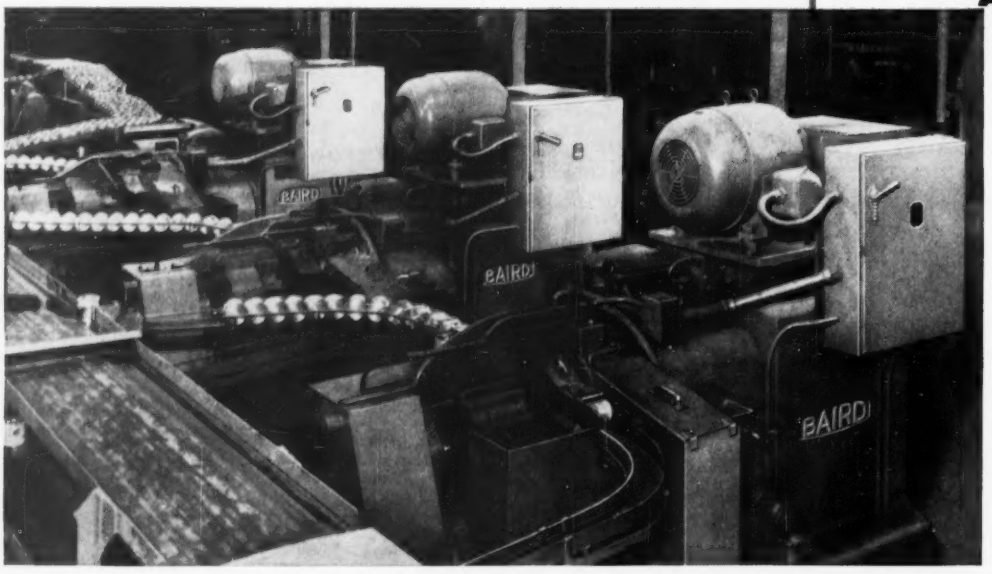


RELIANCE ELECTRIC AND ENGINEERING CO.

1077 Ivanhoe Road, Cleveland 10, Ohio • *Sales Representatives in Principal Cities*

. . . IF IT'S A HIGH PRODUCTION PROBLEM . . .

ASK BAIRD ABOUT IT



ENGINE PISTONS *travel fast* THRU *automatic* ASSEMBLY *of* BAIRD 6-SPINDLE CHUCKERS

With push-button operation in many large metal working plants, the Baird Chucker has graduated from a valuable single unit to an invaluable assembly for completely automatic production lines.

Higher, constant speed is one reason . . . minimum manpower . . . and maintenance of close tolerances during continuous removal of metal is, perhaps, the outstanding feature. The photo above shows an assembly of three Baird Chuckers automatically machining engine pistons in a leading automobile plant.

In this instance, operations include finish turning of the engine piston and finishing the oil ring grooves to size.

This Model 76H Chucker (7″ chucks, 6-spindle horizontal machine) combines, in a single indexing cycle, such operations as turning, facing, drilling, tapping, threading, grooving and chamfering, if required.

Electrical and mechanical safety devices prevent damage when any motions are out of time or sequence. All tooling is easily accessible . . . spindle speeds are individual and variable. Design and construction assure long service life. If you require repetitive production of this nature . . . hand load or unload or entirely automatic . . . ask Baird about it.

3BA54

THE BAIRD MACHINE COMPANY
STRATFORD CONNECTICUT

WHERE YOU WILL GET THE HELP OF SPECIALISTS ON THESE ESSENTIAL PRODUCTION PROBLEMS:

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

For more information on products advertised, use Inquiry Card, page 241

UNIVERSAL
DRILL BUSHINGS OUTLAST THEM ALL!

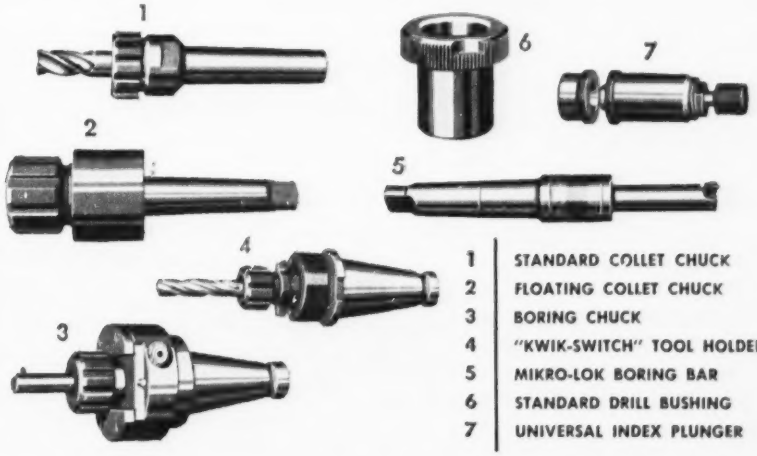


Several factors contribute to the long life of Universal Drill Bushings. They are machined from an unusually high quality steel. Their superfinish bores reduce wear. The blended radius on the top inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests help guarantee their accuracy and uniform quality. Knurled heads provide a quick, sure grip. Available in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you — Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis. — or our home office.

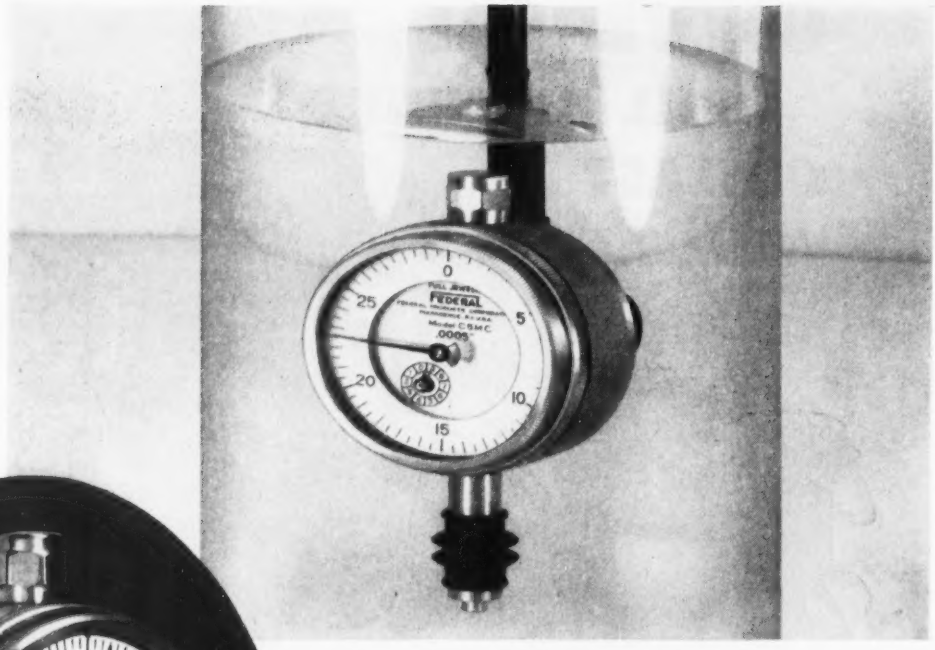
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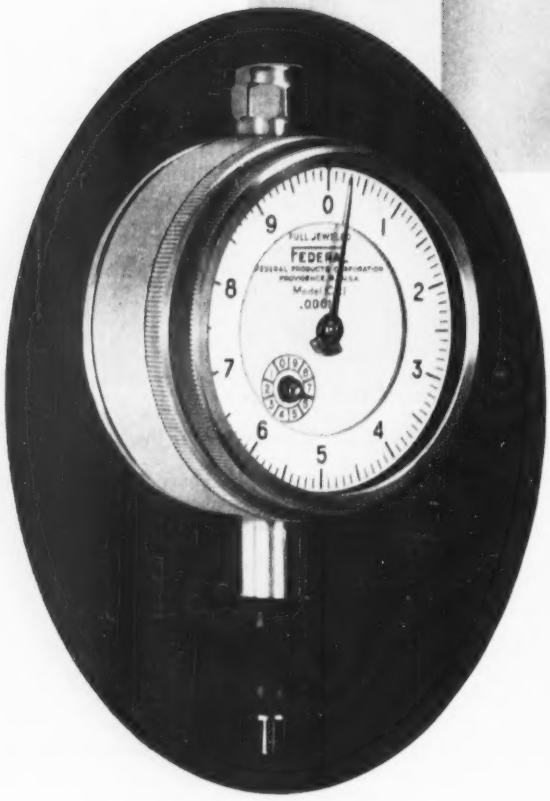
UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 2, MICHIGAN



1	STANDARD COLLET CHUCK
2	FLOATING COLLET CHUCK
3	BORING CHUCK
4	"KWIK-SWITCH" TOOL HOLDER
5	MIKRO-LOK BORING BAR
6	STANDARD DRILL BUSHING
7	UNIVERSAL INDEX PLUNGER





You can splash, dunk, or spray this Wetproof Dial Indicator. It will give excellent performance and greatly cut maintenance costs.

AND NOW!
A WETPROOF DIAL INDICATOR

Completely Sealed—Wholly Protected from Coolant, Oil, Oil Fog, and other Liquid Contaminants

IN ANSWER TO REPEATED REQUESTS from Dial Indicator users, Federal now announces this WETPROOF DIAL INDICATOR which eliminates maintenance troubles commonly encountered under adverse operating conditions. "W" Series Dial Indicators are completely wetproofed and built unusually rugged to withstand heavy handling. The internal mechanism is protected by tightly sealed external openings. THE CRYSTAL IS OF GLARE-PROOF GLASS remarkably free of halations. It will not discolor when exposed to oil or staining liquids. A heavy duty case and four oversize back screws make these exceptionally durable Indicators. They are regularly furnished with revolution counter and Cushion Movement. The dial rotates for zero (0) setting. Available in "C" size (2¼" O.D.) and made to AGD specifications (except for minor variations). TRY THIS NEW INDICATOR ON YOUR TOUGHEST JOBS. Write

FEDERAL PRODUCTS CORPORATION
4118 Eddy St., Providence 1, Rhode Island

Ask **FEDERAL**

FOR ANYTHING IN MODERN GAGES...

Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting or Automatically Controlling Dimensions on Machines



The new Air Bore Gage brings to small run jobs the basic advantages of the Dimensionair's stable accuracy, precisely calibrated scale, fast set-up, and long range.

THESE ARE NEW



Adjustable AIR BORE GAGES

Get the advantages of extreme accuracy at low cost on smallest production runs

A MAJOR ADVANCEMENT IN AIR GAGING, Federal's Adjustable Air Bore Gages bring the sensitive accuracy and high magnification of the DIMENSIONAIR measuring system to job or to production runs. FOUR GAGES COVER A MEASURING RANGE FROM ½" TO 8". Their light weight makes them very easy to handle. Particularly in the larger sizes and where holes with large diameters are difficult to reach, these light weight gages provide a convenient, non-fatiguing method of checking holes with air.

Since the centralizing contacts are concentric with the axis of the gaging contacts, the gages can be set with gage blocks and measurements transferred to a hole with no significant error. Repetitive accuracy is outstanding. Learn more about this latest development in air gaging. Write

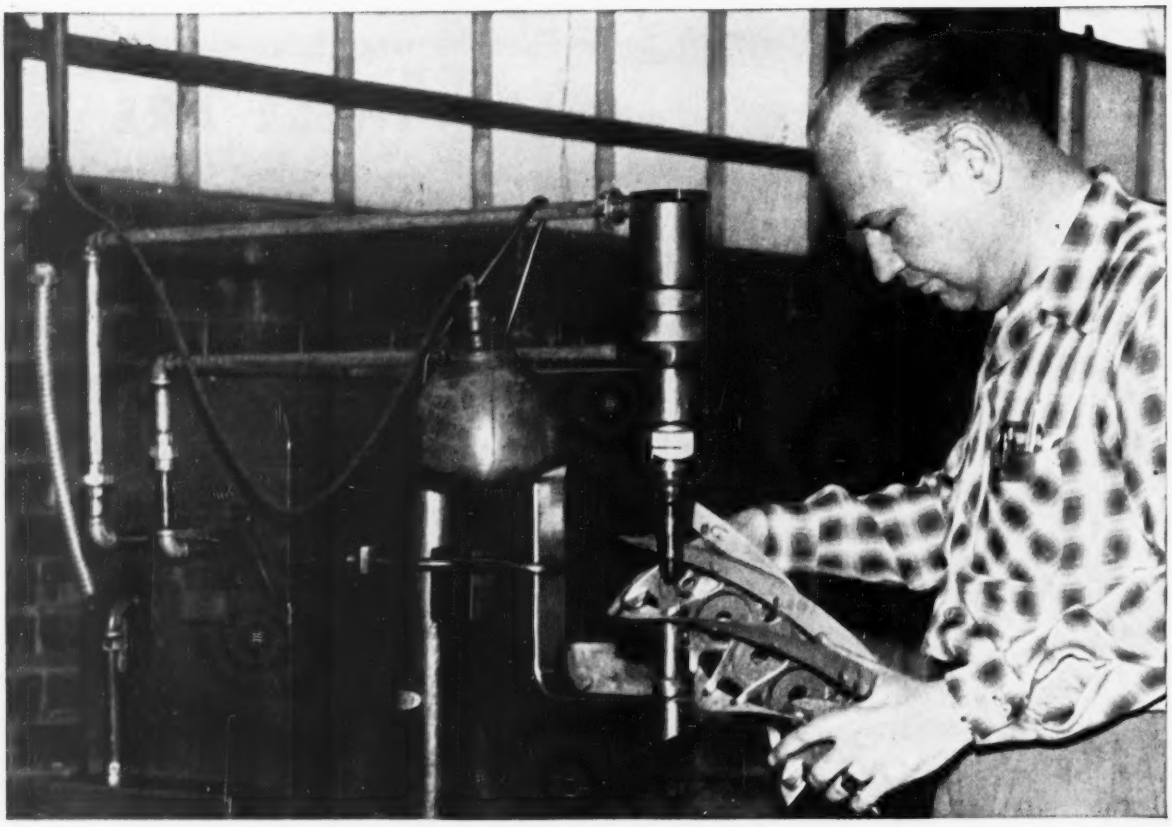
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4118 Eddy St., Providence 1, Rhode Island

All models of Adjustable Air Bore Gages are regularly furnished with Tungsten carbide gaging contacts. These gages can be used with either the 2500 TO 1 MAGNIFICATION or 5000 TO 1 MAGNIFICATION Dimensionairs, including those now in use throughout industry.

Ask **FEDERAL**

FOR ANYTHING IN MODERN GAGES...

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting or Automatically Controlling Dimensions on Machines



Courtesy Eclipse Lawn Mower Company, Prophetstown, Illinois

HOW TO MAKE A BETTER ASSEMBLY CHEAPER

RIVETING THE "HY-POWER" WAY

Lawn mower blades must be fastened to the reel tightly and *in perfect alignment* to assure product performance and acceptance. That's why the Eclipse Lawn Mower Company, Prophetstown, Illinois (as well as many other leading lawn mower manufacturers), uses Hannifin "Hy-Power" cold-squeeze riveting.

What's your assembly problem?

If you haven't investigated fast, safe, clean cold-squeeze riveting, perhaps you should! Parts are drawn tightly together under quiet, relentless hydraulic pressure. Rivet shanks expand to fill the hole completely, making the tightest joint possible; heads are formed to any shape and every rivet is identical. And, with this modern push-button-controlled method, operators need no special training to apply it.

"Hy-Power" Riveters are available, standard or special, for portable use or in fixed mountings, as shown. Power source is the exclusive Hannifin "Hy-Power" Hydraulic Pressure Generator—so dependable that the first model, made nearly 20 years ago, is still in daily use.

ONE RIVET AT A TIME OR SEVERAL!

Hannifin "Hy-Power" Riveting is ideal for multiple installations where several "Hy-Power" Cylinders—available in capacities from 7½ to 100 tons—advance, rivet and retract in unison. Your Hannifin representative is anxious to help you select exactly the "Hy-Power" installation you need. Why not call him in? Meanwhile, get the full story by writing for Bulletin 150.



HANNIFIN

Hannifin Corporation, 1109 S. Kilbourn Ave., Chicago 24, Ill.

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

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This is the difference High Velocity Turning makes

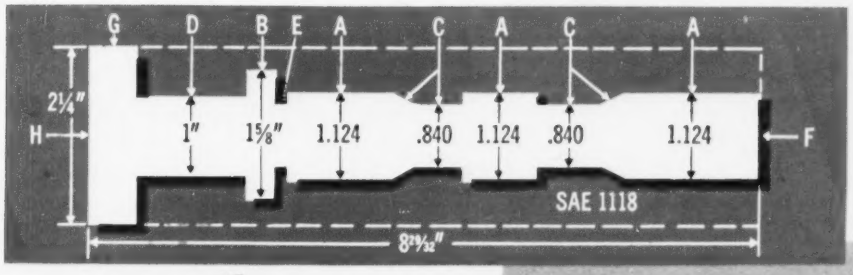


IN 1947 this job took...

11.50 min.

FLOOR TO FLOOR

A. Turn — 694 RPM — .015" Feed
B. Turn — 489 RPM — .015" Feed
C. } Form — 119 RPM — .0025" Feed
D. }
E. Face, shoulder, neck, undercut, HSS
F. Face 243 RPM — .0035" Feed
G. Knurl
H. Cut off — 243 RPM — .0035" Feed





IN 1954 this same job takes...

5.00 min.

FLOOR TO FLOOR

A. Turn — 1000 RPM — .022" Feed
B. Turn — 1000 RPM — .022" Feed
C. } Form — 340 RPM — .0035" Feed
D. }
E. Face, shoulder, neck, undercut
F. Face 489 RPM — .0055" Feed
G. Knurl
H. Cut off — 489 RPM — .0055" Feed

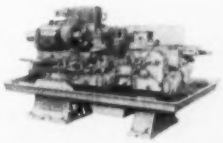
J & L TURRET LATHES GIVE...

MORE Ease of Operation
MORE Power Transmission
MORE Rigidity
MORE Accurate Stops
MORE Efficient Lubrication
MORE Coolant on Cutting Tools
MORE Accurate Results

Turning out a job like this in 5 min. calls for a lathe with plenty of power and the beef to back it up . . . a lathe like the Jones & Lamson #7A Universal Turret Lathe, which is specially designed to meet today's demand for more production at lower unit costs.

Only with a lathe like this can your shop take full advantage of the quality, productivity and lower costs offered by High Velocity Turning.

This job is one of the many turned at high speeds on our production line. Come to Springfield and see for yourself. At any rate, send for catalogs #101-A and #102.



JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

J&L MACHINE TOOL DIV.

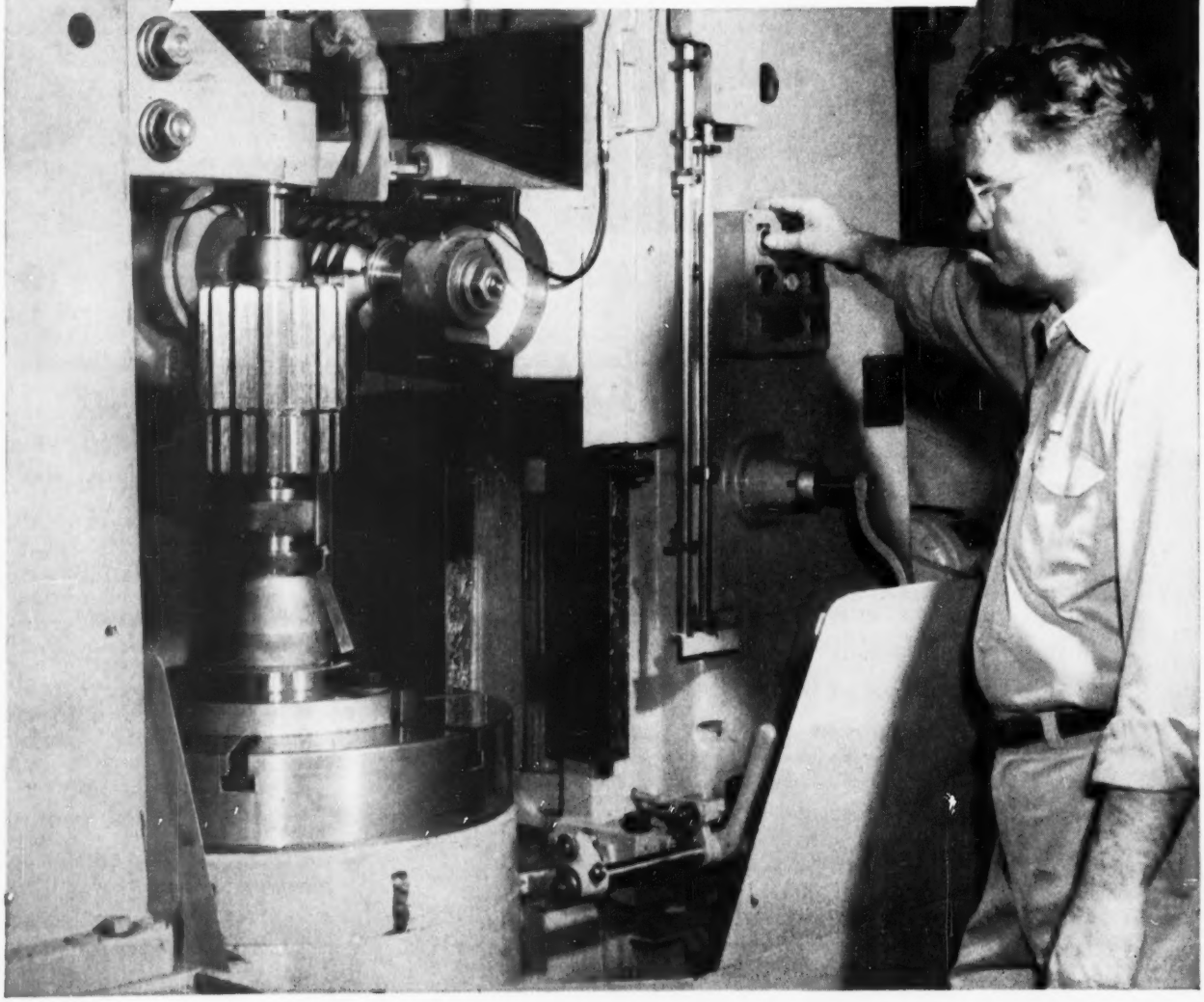
For more information on products advertised, use Inquiry Card, page 241

SCULLY JONES

"Precision

make hobbing...and

Special "Roll-Lock" Hobbing Fixture improves pitch-line concentricity and boosts production of drive pinions at Allis-Chalmers Mfg. Co.



Holding" Tools

other machining jobs more profitable

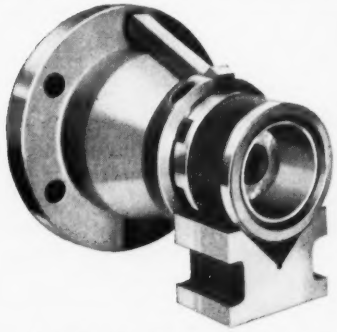
Provides accurate, centering, shrink fit on ground hub of pinion.

It's a new way of holding and driving the work for hobbing . . . as accurate as holding between centers . . . faster and *more accurate* than conventional chucking.

This Scully-Jones special "Roll-Lock" Chucking Fixture easily increased production of tractor drive pinions 10% by reducing handling time and increasing rigidity to permit heavier feeds. Other benefits reported are:

Pitch-line concentricity and accuracy of involute were improved because the solid compression shell applies *equal force* evenly around the ground hub of the pinion, accurately centering it . . . and eliminates all clearance or play. Hob life was increased, too, and finish was improved because vibration is eliminated.

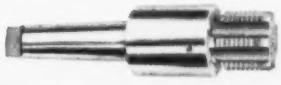
Use of Scully-Jones standard or special "Roll-Lock" Chucks, Arbors and Mandrels *on a variety* of your machining operations will be just as profitable. Read about wide range of application in Bulletin No. 17-50.



Special "Roll-Lock" Chuck is bolted to work spindle of Gould & Eberhardt gear hobber. Spacers adapt it to various hub lengths. Split collets are used to accommodate different diameters.

THE SCULLY-JONES TOOL BUYER'S GUIDE

Heavy-Duty Tap Holders—Hold and drive large taps in machines having a Morse taper hole. Special alloy steel, hardened by toughening process, resists nicking and burring . . . keeps taps running true. Shank and hole concentric within .002". Standard sizes for hand and pipe taps, from ¼" to 3". Bulletin No. 4-50.



Center Drill Drivers—Accurately drive combined center drills and countersinks (regular and bell types) because bore and shank are precision finished. Flutes drive off spline section of bore. Countersunk hole protects drill tip. Morse taper shanks, 15 sizes for ⅛" x 3/64" to ¾" x 5/16" drills. Bulletin No. 1-50.



Close-Center Tap Drivers—Give maximum clearance between centers or near shoulder. Permit use of hand taps in place of pulley taps and special length taps. New improved design assures long life. Short, medium and long series. Bulletin No. 4-50.



Drill Stops—Use them on turret lathes, radial drills and other machines to control depth of hole. Save time on sequence operations using quick-change setup. Eight standard sizes, with Morse taper shanks and hole dia. from ¼" to 1½". Bulletin No. 18-50.



Quick-Change Chucks—Change tools fast on sequence drilling, reaming and tapping jobs without stopping machine. Merely lift locking ring, and collet with cutting tool drops out. After inserting new collet, release ring and tool is ready to cut. Collets for Morse taper shanks. Bulletin No. 3-50.



Sleeves, Sockets, and Turret Tool Holders—Hardened-and-ground precision sleeves reduce any ASA or Morse taper hole to smaller taper. Short, medium and long series extension sockets handle most jobs. Short, sleeve, and extension type turret tool holders in wide range of sizes. Bulletin No. 7-50.



Milling Arbors—Styles "A" and "B" provide rigid, accurate drive on machines having National Standard spindle end. Arbor and pilot dia. held to +.0000", —.0005". Faces of spacers and bearings parallel within .0002". Keep cutters true. Standard sizes with 40 and 50 NMTB tapers. Bulletin No. 2-50.



Milling Machine Adapters—Shell end mill arbors available in range of sizes and styles. Collet holders, cutter chuck adapters, centering plugs and other adapters stocked for fast service. Bulletin No. 2-50.



Solid Spacing Collars—Do not "spring" arbors because faces lapped parallel within .0002". Keep cutters running true. Standard sizes, from .006" to 6" thick, ⅞" to 2½" bore. Bulletin No. 2-50.



Arbor Bearing Sleeves—For standard styles "A" and "B" arbors. Bore and O.D. concentric within .0005"; faces parallel within .0002". Standard sizes from ⅞" to 2½" bore dia. Bulletin No. 2-50.



Live Centers—Use them for high speed turning without losing accuracy. Extra large bearing surfaces absorb shock loads easily. Runout within .0002" T.I.R. Capacities—1000 to 2400 lbs. Bulletin No. 9-50.



Work Rest Blades—Save many ways. TC tipped segment type blades for through feed, infeed and roller infeed grinding. Range of sizes. Bulletin No. 11-50.



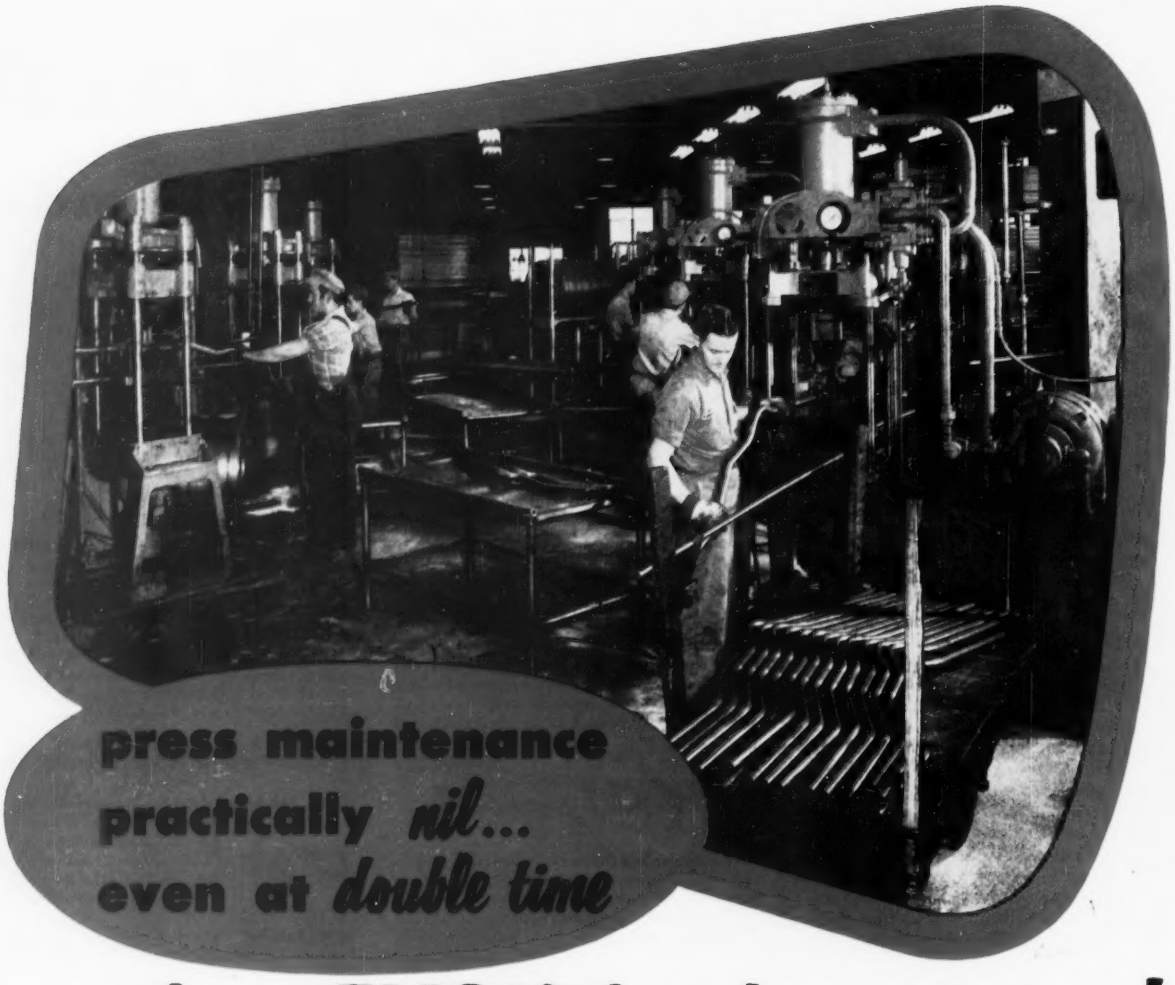
STOCKED BY SCULLY-JONES DISTRIBUTORS IN ALL PRINCIPAL CITIES

SCULLY-JONES

"Precision Holding" for holding precision

SCULLY-JONES AND COMPANY, 1906 S. ROCKWELL ST., CHICAGO 8, ILLINOIS

For more information on products advertised, use Inquiry Card, page 241



press maintenance practically *nil*... even at *double time*

on these ELMES *bending presses!*

Six out of ten Elmes® Hydraulic Tube Benders in operation at Tube Products Corporation, Tipp City, Ohio, are shown above. Used for forming exhaust and tail pipes for automobile, airplane, and diesel engines, these six presses have been in service for four years; the remaining four Elmes presses, not shown, have been in service for eight years.

"These ten presses are in constant operation at least 8 hours daily," says Mr. E. C. Sonnanstine, Tube Products' executive vice-president. "In fact, at least 50% of the time they are in operation for 16 consecutive hours. Yet with all this heavy-duty operation, practically *no* maintenance has been required—only normal replacement of worn gaskets.

"We feel that the use of this equipment, with its simple tooling and exceptionally high operating speed, enables us to produce in quantities a quality product at the lowest possible cost to our customers."

Elmes Hydraulic Metalworking Presses have an enviable reputation for *maintaining* high production . . . because Elmes *builds* performance into its press designs . . . the kind of performance that only 102 years of specialized engineering experience can produce. Whatever your press requirements—for drawing, forming, straightening, bending, hobbing, forcing, etc. — let Elmes' long experience be your guide to better, faster, lower-cost production. Press recommendations and cost estimates are yours for the asking.

American Steel Foundries

ELMES ENGINEERING DIVISION

1162 TENNESSEE AVENUE CINCINNATI 29, OHIO

DISTRIBUTORS IN PRINCIPAL INDUSTRIAL CENTERS — ALSO MANUFACTURED IN CANADA

METAL-WORKING PRESSES • PLASTIC-MOLDING PRESSES • EXTRUSION PRESSES • PUMPS • ACCUMULATORS • VALVES • ACCESSORIES

For more information on products advertised, use Inquiry Card, page 241



Twenty-foot boring mill table turned upside down to show the Farrel ring gear.

gives driving smoothness to boring mill table

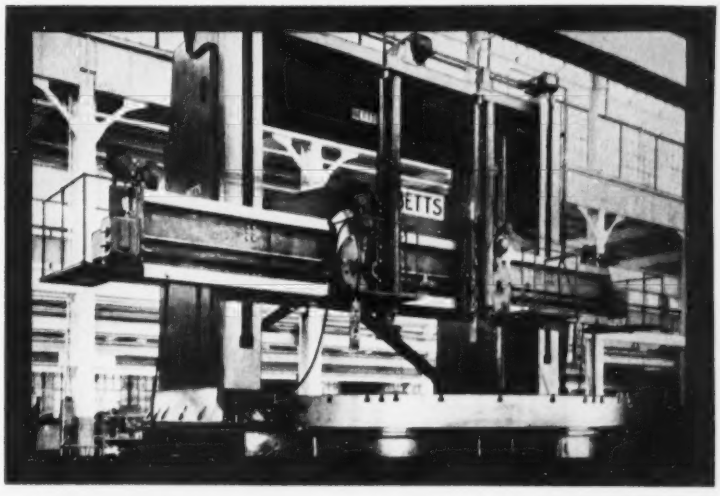
The huge single-helical ring gear built into this twenty-foot boring mill table is an important factor in obtaining an extremely fine finish on work turned on the mill.

Designed to impart driving smoothness to the table, both the gear and its mating pinion are precision generated by Farrel to a high degree of accuracy, and carefully fitted to eliminate the possibility of backlash. The pinion shaft is worm driven and this, together with the wide-angle helical gear, provides a smooth, chatter-free drive.

The gear, which is split, has a 30° right-hand helix angle, 276 teeth, 1½ DP. Its inside diameter is 183.294" and the face is 9¾" wide.

Farrel precision-generated internal gears are available with either helical or spur teeth in sizes up to 16 feet diameter, 12 inch face, ¾ DP. They are made of the finest grade materials.

Farrel engineers will be glad to assist you in working out unusual gear problems. Why not call on them?



The table is used on this Betts boring mill, made by Consolidated Machine Tool Corporation, Rochester, N. Y.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT

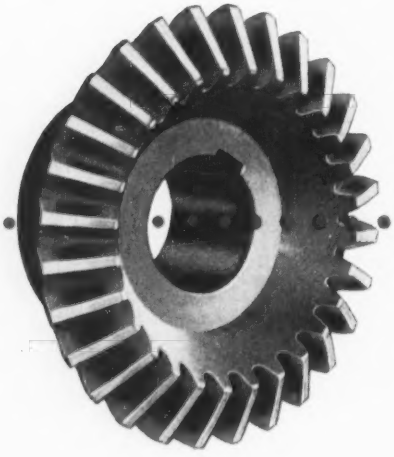
Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Boston, Akron, Detroit, Chicago, Memphis, Minneapolis, Fayetteville (N. C.), Los Angeles, Salt Lake City, Tulsa, Houston, New Orleans

FB-940

Farrel-Birmingham®

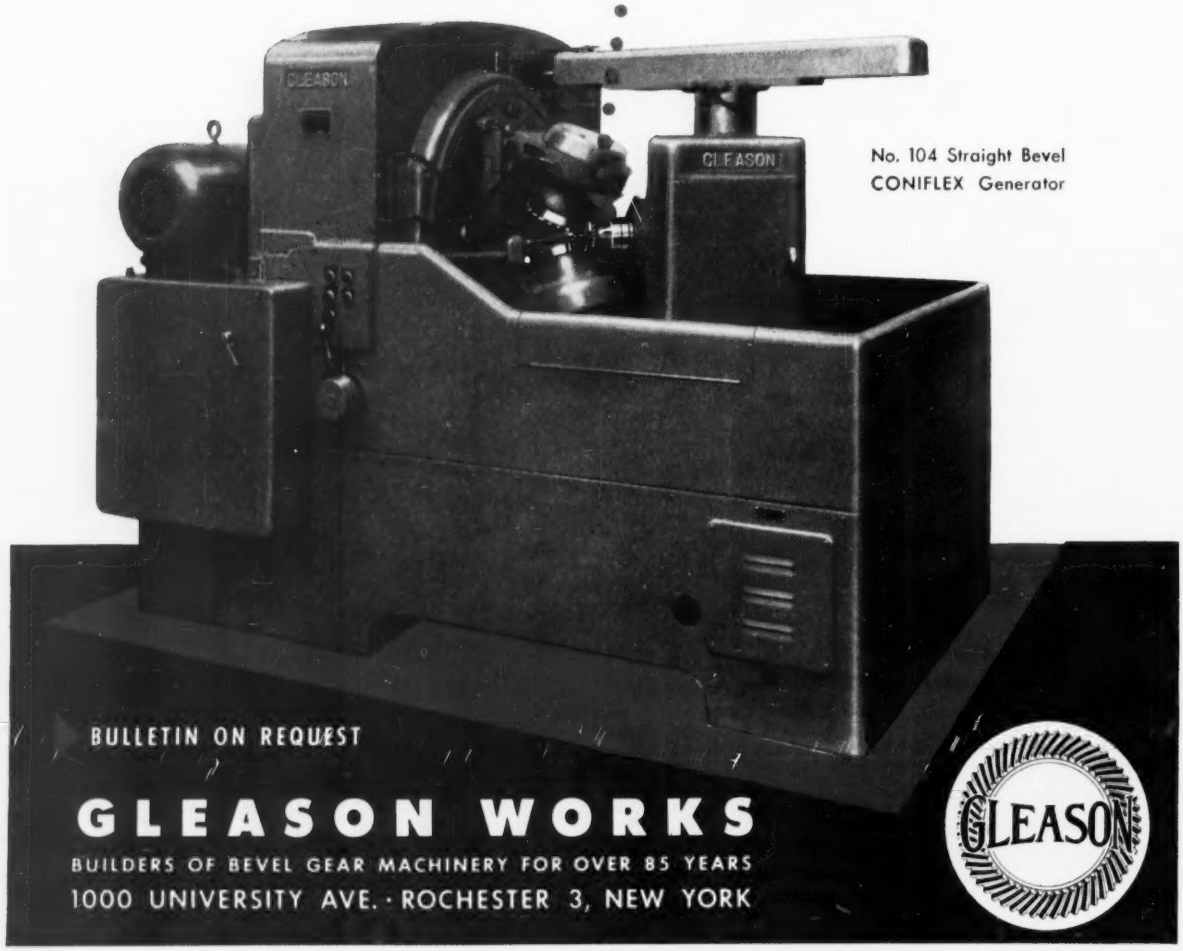
Before . . . 2 cuts

Now . . . 1 cut



This 6 DP, 28-tooth straight bevel gear formerly required separate roughing and finishing cuts—totaling 19.3 minutes floor to floor time. Now it is completed on the No. 104 Straight Bevel CONIFLEX® Generator in one cut requiring 3.3 minutes ***—a production increase of over 500%*** with no sacrifice of quality!

All gears within the range of this new generator (20 DP to 3 DP and 8½" diameter) are generated by the one-cut completing method—with localized tooth contact. The No. 104 Generator is ideal for job lots or continuous production.



No. 104 Straight Bevel CONIFLEX Generator

BULLETIN ON REQUEST

GLEASON WORKS

BUILDERS OF BEVEL GEAR MACHINERY FOR OVER 85 YEARS

1000 UNIVERSITY AVE. · ROCHESTER 3, NEW YORK

GLEASON

For more information on products advertised, use Inquiry Card, page 241



Colonial "SUBTRACTING" machines

they subtract production costs ...add to profits

Subtraction #1—the *Broach.* With the Colonial broach designed specifically to broach the part efficiently to the tolerances specified at the required rate of production, cost subtraction starts.

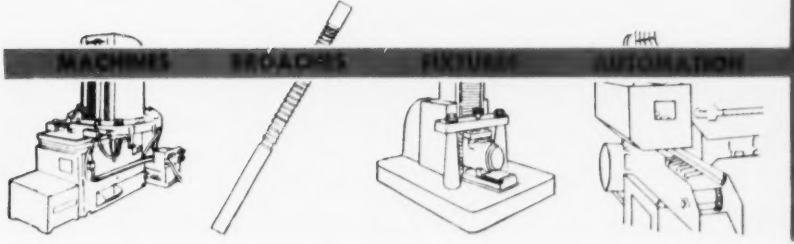
Subtraction #2—the *Machine.* Selecting one of the more than 60 dependable Colonial broaching machines capable of handling the broach at the specified rate of production is the next important step in subtracting costs.

Subtraction #3—the *Fixture.* The Colonial fixture, locating and clamping the part in broaching position, while at the same time permitting maximum accessibility for loading and unloading, is another important step in cost subtraction.

Subtraction #4—the *Automation.* Where high production requirements make loading and unloading time an important factor, the Colonial automation of the broaching installation will serve to further subtract machining costs.

ADDITION—By adding the four important Colonial cost subtracting features above, today's cost conscious metalworking plant has a complete *Colonial Unified Broaching Installation* capable of producing the part at lowest possible cost with utmost accuracy. To subtract costs and add to profits in your plant, ask Colonial Broach to quote on Unified Broaching installations for your parts.

Ask for bulletin 877 on complete line of Colonial broaching machines



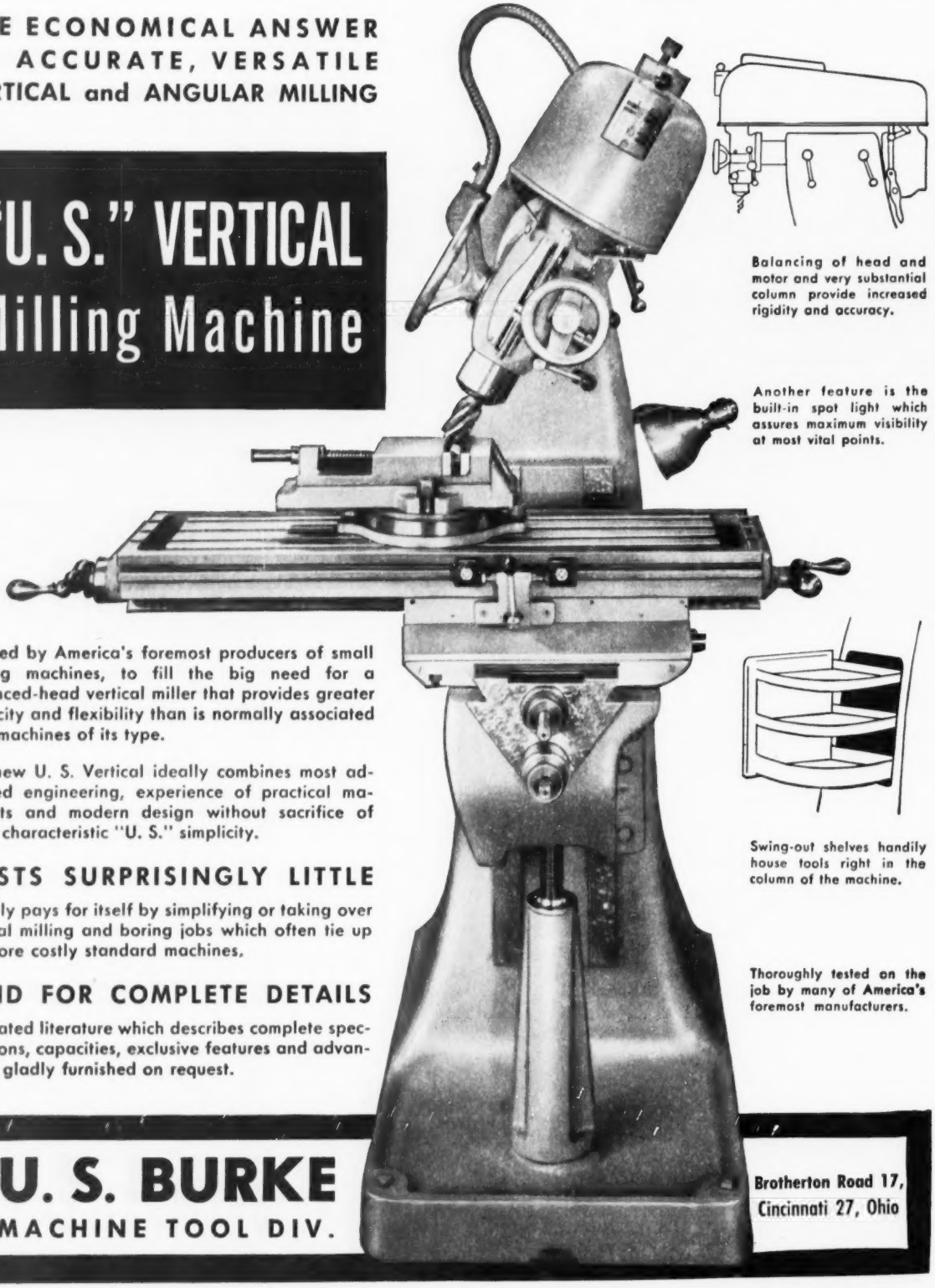
Unified Broaching

COLONIAL

NEWEST OF THE U. S.-BURKE SUPER-VALUE MACHINE TOOLS

THE ECONOMICAL ANSWER TO ACCURATE, VERSATILE VERTICAL and ANGULAR MILLING

"U. S." VERTICAL Milling Machine



Balancing of head and motor and very substantial column provide increased rigidity and accuracy.

Another feature is the built-in spot light which assures maximum visibility at most vital points.

Swing-out shelves handily house tools right in the column of the machine.

Thoroughly tested on the job by many of America's foremost manufacturers.

Created by America's foremost producers of small milling machines, to fill the big need for a balanced-head vertical miller that provides greater capacity and flexibility than is normally associated with machines of its type.

The new U. S. Vertical ideally combines most advanced engineering, experience of practical machinists and modern design without sacrifice of basic characteristic "U. S." simplicity.

COSTS SURPRISINGLY LITTLE

Quickly pays for itself by simplifying or taking over vertical milling and boring jobs which often tie up far more costly standard machines.

SEND FOR COMPLETE DETAILS

Illustrated literature which describes complete specifications, capacities, exclusive features and advantages gladly furnished on request.

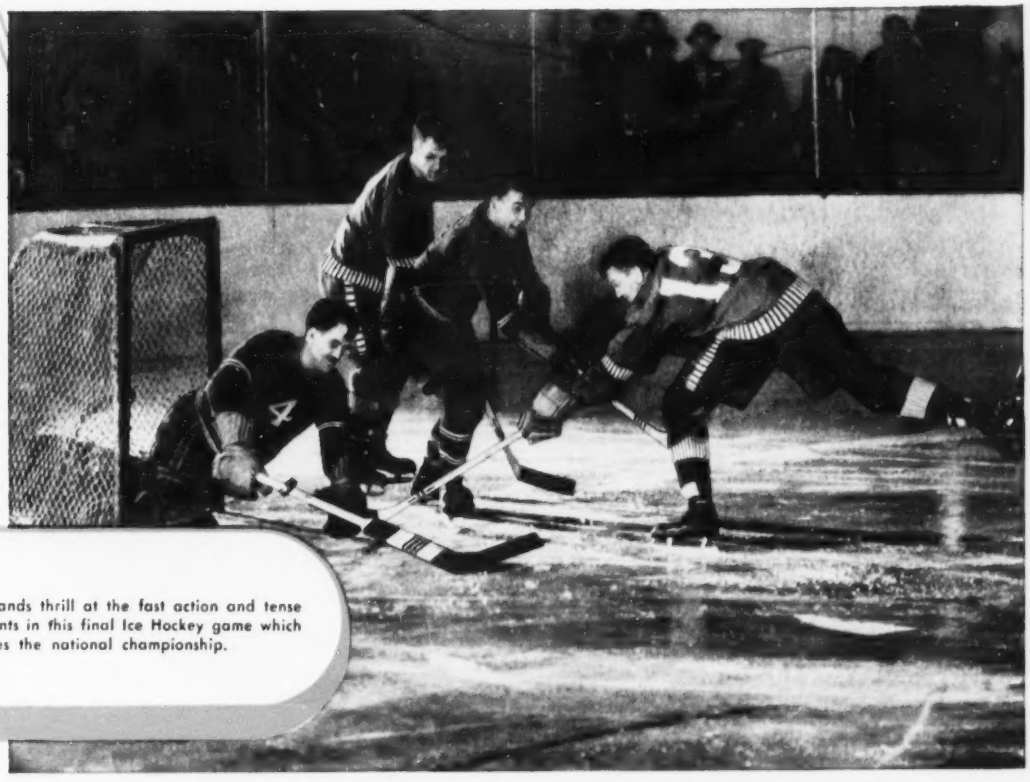
U. S. BURKE
MACHINE TOOL DIV.

Brotherton Road 17, Cincinnati 27, Ohio

For more information on products advertised, use Inquiry Card, page 241

LOGAN . . . a national participant in major fluid power advancements

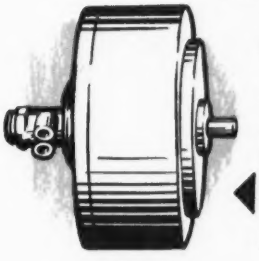
SINCE 1916



Thousands thrill at the fast action and tense moments in this final Ice Hockey game which decides the national championship.

LOGAN ROTATING AND NONROTATING AIR CYLINDERS

FAST-ACTING, POSITIVE CONTROLLED POWER . . . AT LOW COST



Rotating Air Cylinder

NONROTATING—7 STANDARD MOUNTING TYPES

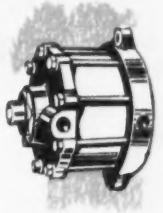
Standard sizes from 1½" to 16" bore; maximum stroke, 18 feet. Special models to meet your requirements.

Logan Features—Larger Ports . . . More Sturdy Construction . . . Maximum Power Without Leakage . . . Permanent Seal Around Piston Rod . . . Standard Models With or Without Cushioning.

ROTATING

Two Standard Styles—Type R with cast iron body; Type K with lightweight aluminum body.

Bore diameter 1½" to 20"; piston stroke 1" to 2"; longer strokes available as special. American Standard adaptations.



Nonrotating Double-Acting Air Cylinder

Consult Logan for your special heavy-duty, mill-type cylinder requirements

LOGAN MANUFACTURES 6,975 STANDARD CATALOGED ITEMS

FREE CATALOG ON REQUEST

AIR CONTROL VALVES, Cat. 100-4 · AIR CHUCKS, Cat. 70-1 · AIR CYLINDERS, Cat. 100-1 · AIR-DRAULIC CYLINDERS, Cat. 100-3
AIR and HYDRAULIC PRESSES, Cat. 51 · COLLET GRIP TUBE FITTINGS, Cat. 200-5 · HYDRAULIC CONTROL VALVES, Cat. 200-4
HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 · HYDRAULIC POWER UNITS, Cat. 200-1 · SURE-FLOW COOLANT PUMPS, Cat. 62

SAVES TIME — Logan — AIR AND HYDRAULIC EQUIPMENT — EFFORT-MOTION

LOGANSPORT MACHINE CO., INC., 810 CENTER AVE., LOGANSPORT, IND.



"Silica in die castings was shortening tool life"

Because of the silica content in zinc aluminum alloy die castings, a well known midwestern manufacturing company had the problem of shortened tool life. During a routine call, Sinclair Lubrication Engineer K. W. Cross learned of this difficulty in machining.

"After studying the problem I recommended Sinclair CADET® OIL 'Z' in place of the competitive cutting oil being used," Mr. Cross reports. "I was certain that its low viscosity, excellent wetting quality and ability to flow into deep holes to be threaded, would provide greater cooling and *longer tool life*.

"A test of Sinclair CADET OIL 'Z' proved I was right," Mr. Cross continued. "Moreover, due to the low viscosity of the oil, the machined parts had practically no carry-off, and consequently *oil consumption was reduced*. This company is now using Sinclair CADET OIL 'Z' for all machining of castings."

SINCLAIR LUBRICANTS

Why not give a Sinclair Lubrication Engineer the chance to help solve *your* cutting and lubrication problems? There's no obligation. Call your Sinclair Representative or write Sinclair Refining Company, Lubricating Sales Department, 600 Fifth Avenue, New York 20, N. Y.

For more information on products advertised, use Inquiry Card, page 241

PRATT & WHITNEY

2B DIE SINKER

equipped with

GOODRICH HYDRAULIC DUPLICATOR

produces

ALL CHERRYING CUTS

with inexpensive shank-type cutters and

WITHOUT EXTRA ATTACHMENTS

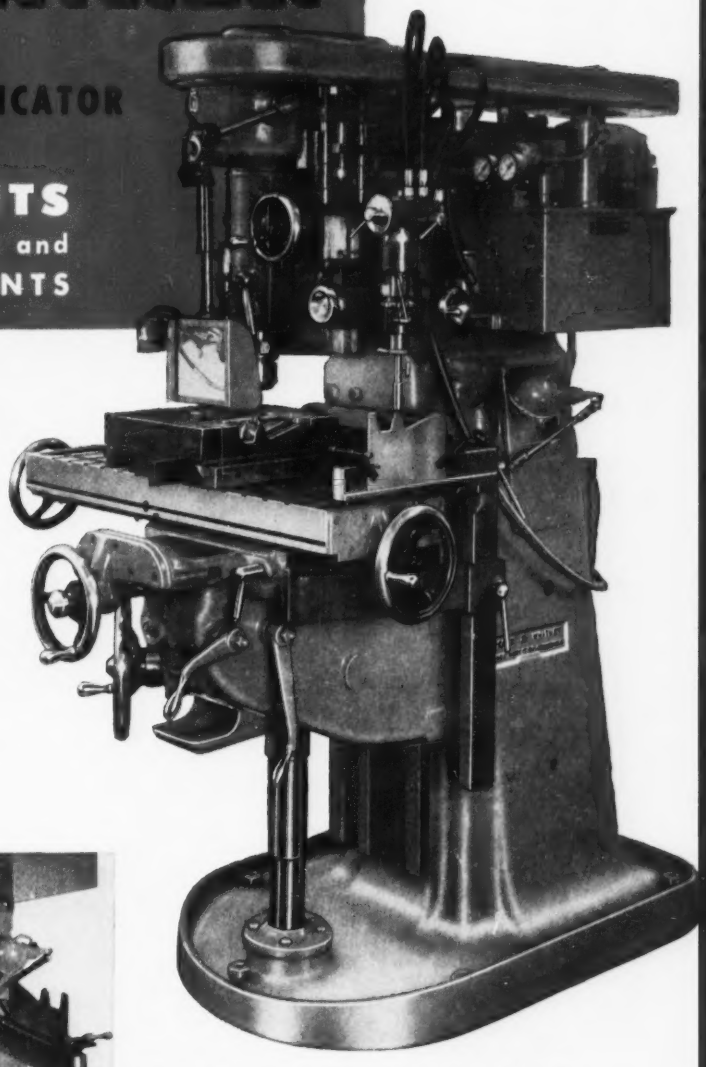
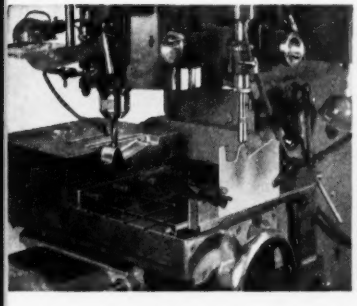
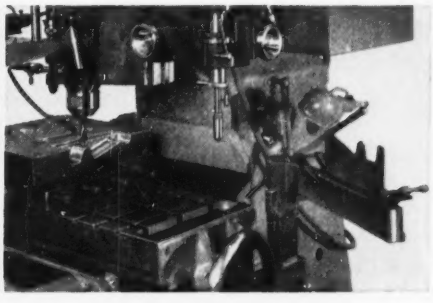


TABLE WORKING SURFACE: 12" x 36"

Fast, accurate and reliable, the Pratt & Whitney 2B Plain Die Sinker equipped with the Goodrich Hydraulic Duplicator simplifies and speeds up all die sinking jobs. Working from a full, 3-dimensional model or an inexpensive, easy-to-make template, the 2B Machine faithfully duplicates all curves and angles of the master form. Many more types of cuts can be made, using inexpensive shank cutters, than are possible with the conventional cherrying attachment; there is an infinite range of radius cuts . . . concave or convex. Much layout work is eliminated. Operation is convenient with cutting action under complete control at all times. Fatigue is greatly reduced, productivity increased.

The P&W 2B Die Sinker is also available without the Goodrich Duplicator but with the necessary mounting pads should you wish to add this feature later. If die sinking is an important part of your operations, the 2B is a "must" for your modernization and replacement program.





Shape of the template is accurately duplicated in the die block. As shown at the right, template can easily be swung out of the way.

SEND FOR COMPLETE INFORMATION . . .

. . . see how the 2B Machine can help to make your die sinking operations more efficient, more profitable. Write today on your Company letterhead.

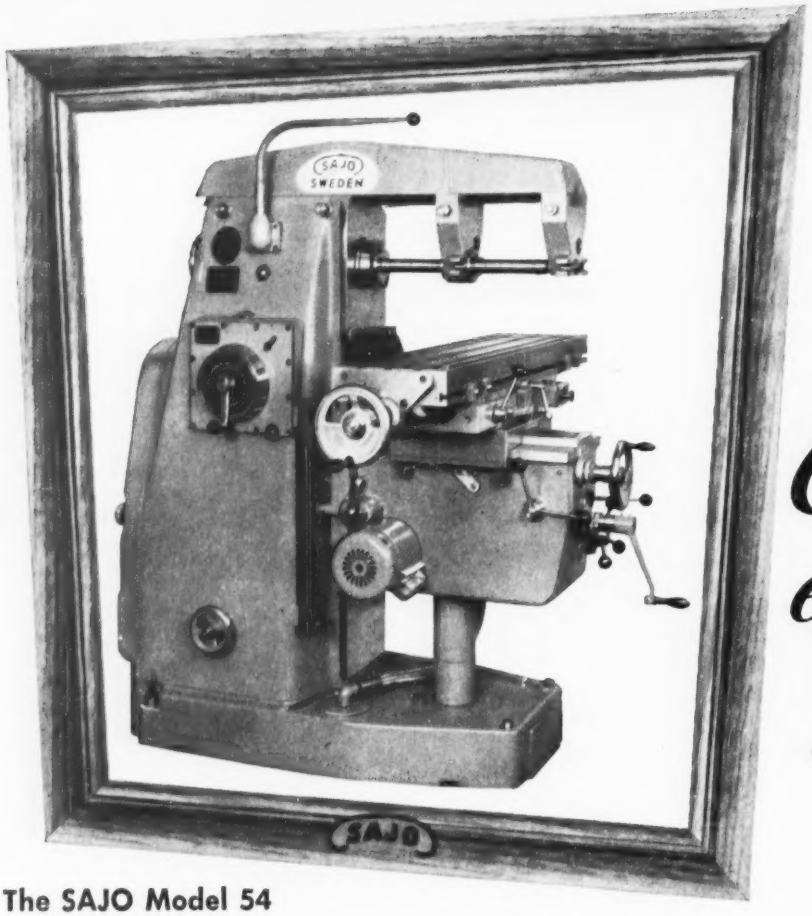
PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U.S.A.

MODERNIZE with PRATT & WHITNEY REPLACE FOR PROFIT

First Choice P&W *for Accuracy*

Branch Offices . . . BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DALLAS (The Stanco Co.) • DETROIT • HOUSTON (The Stanco Co.) LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., WEST HARTFORD

MACHINE TOOLS • CUTTING TOOLS • GAGES



Classic example

OF SWEDISH CRAFTSMANSHIP

The SAJO Model 54
No. 2 ALL-GEARED Milling, Machine Plain or Universal

is an outstanding example of Swedish craftsmanship and fine quality materials, combined in a modern design.

Capable of continuous dependable service under the most severe conditions and guaranteeing maintenance of accuracy to tenths, the SAJO Model 54 Millers meet all requirements for:

POWER . . . . . 7½ HP motor drive to spindle (5 HP optional).
1½ HP table feed and rapid traverse motor.

RANGE . . . . . 16 spindle speeds 39-1500 RPM (optional 31-1200 RPM).
12 table feeds 11/16" to 25"/min. longitudinal and cross.
11/32" to 12½"/min. vertical.
Power rapid traverse 96"/min. longitudinal and cross. 48"/min. vertical.
Table travel longitudinal 33½". Cross 10". Vertical 18".

ACCURACY . . . . Handscraped sliding surfaces, Spindle (#50 NMT taper) mounted in four precision SKF bearings ensuring constant smooth operation and fine finish.

SIMPLICITY . . . . . Single adjustable START-STOP-BRAKE lever, Dial selection of speeds and feeds.

Priced well below levels of comparable top grade millers.

Prompt delivery. Full selection of accessories available.

Also available: SAJO No. 2 Light Duty Plain or Universal Millers.

For information write to:

austin industrial corp.

76-E MAMARONECK AVE., WHITE PLAINS, N.Y.

Dealers in principal cities

Look for the Austin Seal—your full guarantee of satisfaction.

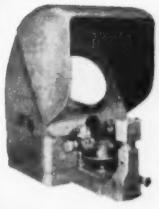
For more information on products advertised, use Inquiry Card, page 241

11 MODELS

3 SCREEN SIZES



Pedestal Type
14" Diam. Screen



Bench Type
14" Diam. Screen
4 Models



Bench Type
5¾" x 7¾" Screen
3 Models

Unsurpassed Inspection Versatility

JONES & LAMSON OPTICAL COMPARATORS

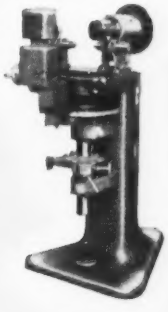
The Essence of Quality Control

Jones & Lamson Optical Comparators are designed and built like rugged machine tools to withstand vibration and hard use. Yet they have the built-in accuracy to satisfy the most exacting laboratory standards.

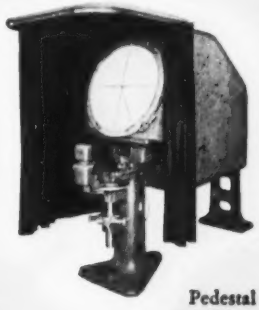
- **They meet** the requirements of toolroom, laboratory and production inspection.
- **They precisely measure** height, depth, lead or spacing, as well as angles to degrees and minutes. They will measure to .0001".
- **They compare** intricately contoured parts with a master outline—and measure the amount of error.
- **They are convenient** to operate, easy to set up and read direct—*without computation.*
- **They operate** under normal lighting conditions. *No darkroom is needed.*
- **They will photograph** the enlarged shadow and record its relationship to a master chart.
- **Several persons** may study the shadow *at the same time.*
- **They will inspect** and measure surface contours, as well as profiles of objects such as type faces, stamping dies, punches, worn tools, etc.



Vertical Type
14" Diam. Screen



Direct
Projection
Type



Pedestal Type
30" Diam. Screen

P.S. A complete line of STANDARD CHARTS and FIXTURES is maintained by us.

JONES & LAMSON *Machine Tool Craftsmen Since 1835*

JONES & LAMSON MACHINE COMPANY
512 Clinton St., Springfield, Vt., U.S.A.

J&L **COMPARATOR DIV.**
Dept. 710



Jones & Lamson Machine Company
512 Clinton Street, Dept. 710
Springfield, Vermont, U. S. A.
Please send Comparator Catalog No. 402.

NAME_____ TITLE_____

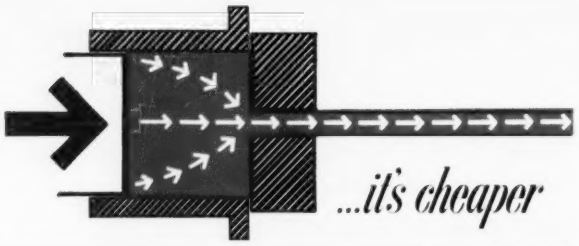
COMPANY_____

STREET_____

CITY_____ STATE_____

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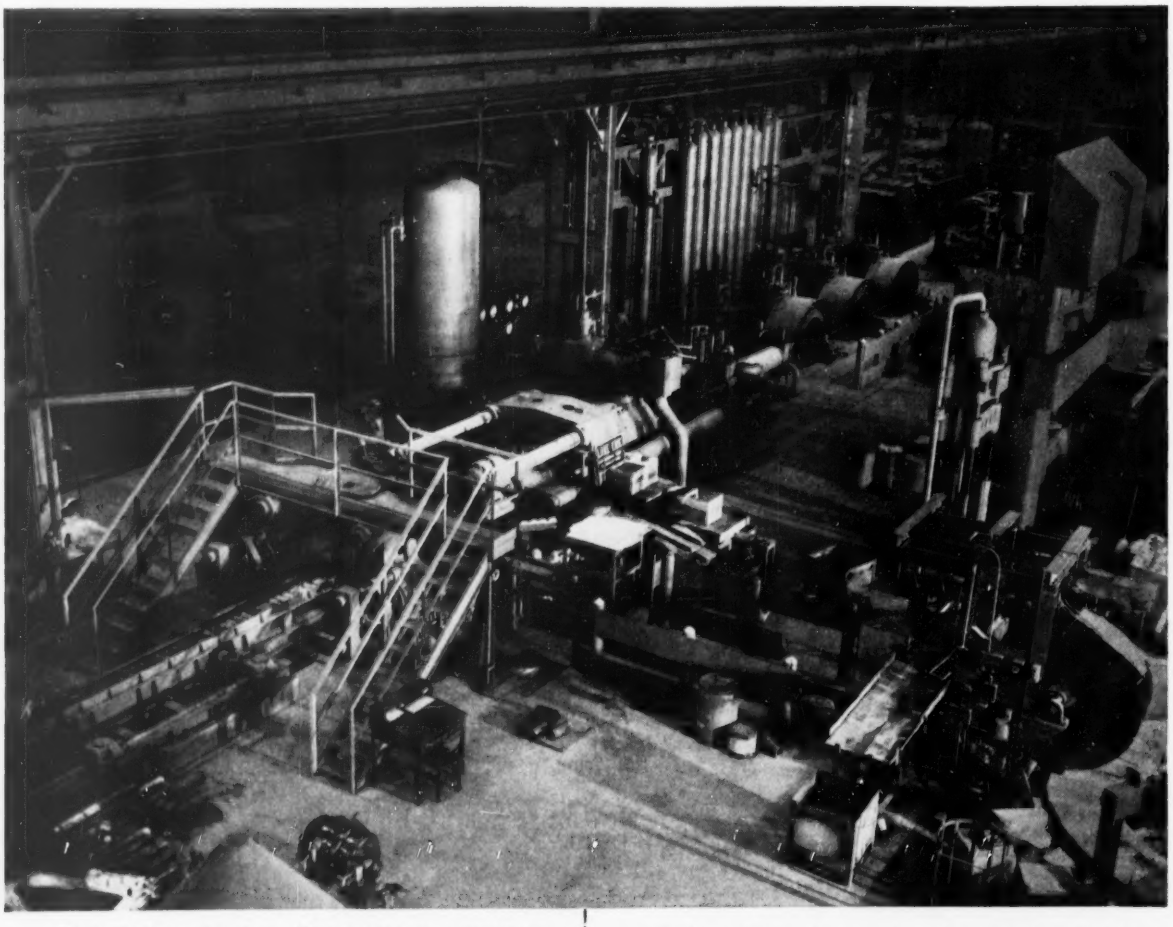
MOVE the metal



...it's cheaper

ALLEGHENY LUDLUM

shows how new method makes big saving in metal and machining



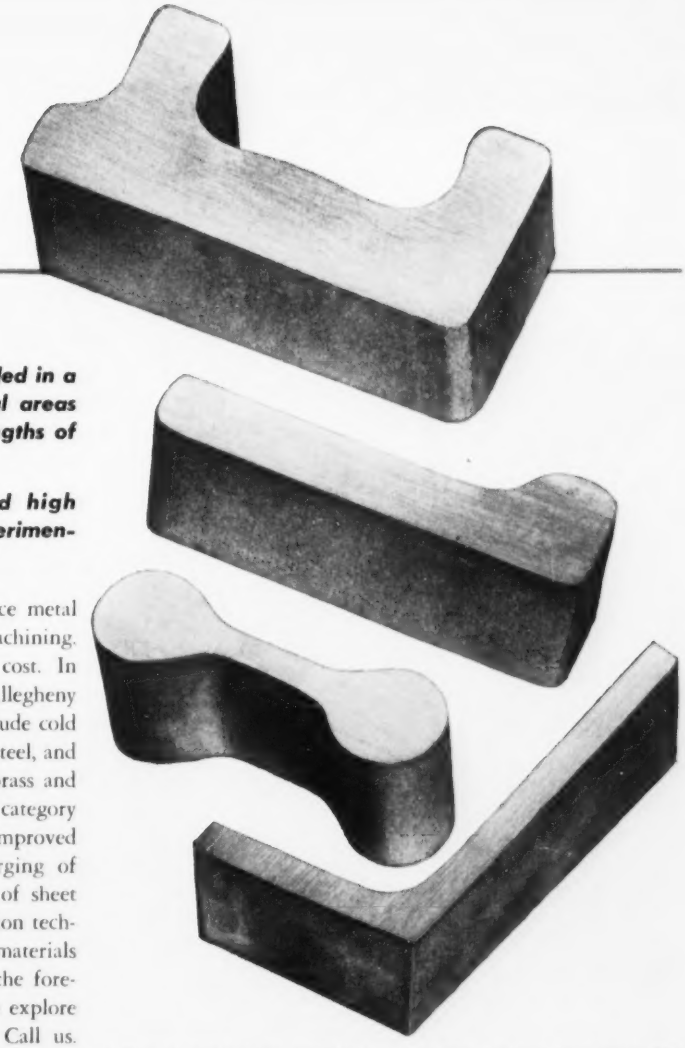
PACKAGED INSTALLATION

A new service by Lake Erie which enables you to order an integrated installation . . . including production equipment, tooling, auxiliary equipment and advisory service . . . from a single source, thereby saving time, money and trouble.

• Allegheny Ludlum's extrusion plant was installed by Lake Erie as a "packaged installation." Heart of the plant is the 1778 ton high speed double cylinder Lake Erie extrusion press. Other major units shown include the accumulator pumping system, salt baths, conveyor system and two Lake Erie piercing presses.

→→→→→→→

than REMOVING it!



• • • Stainless steel is successfully hot extruded in a wide variety of shapes with cross-sectional areas ranging from 0.5 to 3.0 sq. ins. and in lengths of 12 to 60 ft.

• • • Titanium, zirconium, tool steel and high temperature alloys are being extruded experimentally with good results.

• The big trend in metalworking today is to force metal into a desired shape rather than to shape it by machining. This results in new and better products at lower cost. In addition to the type of extrusion done by the Allegheny Ludlum Steel Corporation, these new processes include cold "pressure" forging of aluminum, cold extrusion of steel, and high pressure closed die extruding of aluminum, brass and other non-ferrous alloys. Also falling within this category are somewhat older though greatly changed and improved methods for the extrusion of aluminum, hot forging of ferrous metals, powder metallurgy, deep drawing of sheet and die casting. These new and improved production techniques are already saving millions of dollars in materials and production time. Lake Erie engineers are in the forefront of these developments. They will be glad to explore applications in your production. No obligation. Call us.

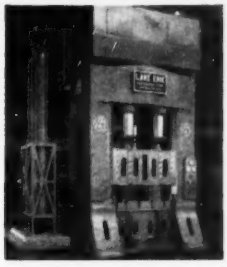
• Typical sections hot extruded by Allegheny Ludlum from series 300 and 400 grades of stainless steel. Included in current production are jet engine rings, turbine blades, special shapes for electronic equipment and similar products. Pieces generally have equal or improved physicals including density and grain structure when produced by "moving the metal rather than removing it."

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HYDRAULIC PRESSES

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LAKE ERIE ®



Closed die extruding of heated aluminum is reducing production time 99% for one Lake Erie customer. ←

Cold steel extrusion is reducing scrap 43% and practically eliminating machining for another Lake Erie customer. →

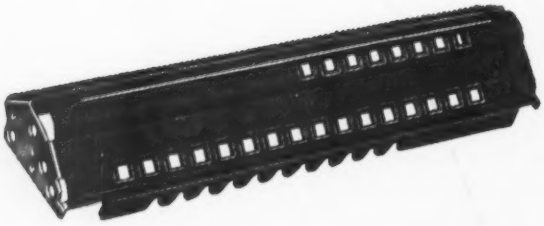


Stainless, seamless tubing is another major product of the Allegheny Ludlum Extrusion Plant. →

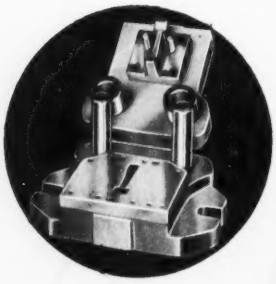


PRODUCTO *Catalog* DIE SETS

SOLVE SPECIAL STAMPING PROBLEM FOR MONROE

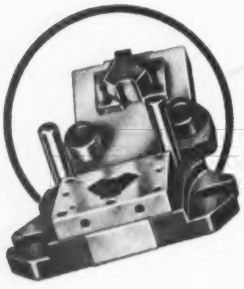


The Problem:
Stamping end-plate holes in the carriage cover of the Monroe Adding Calculator.





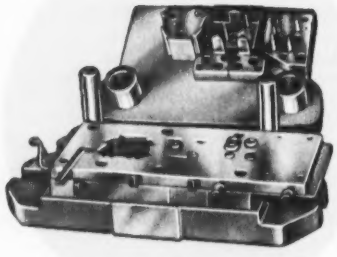




PRECISION

PRODUCTO

New design



THE DIE MANUFACTURER:
The Connecticut Tool and Engineering Co., Bridgeport, Conn.

The lofty die, at right, represents the last critical stamping operation in the production of the Monroe carriage cover, shown above. It's unusual because it pierces close-tolerance end holes in either 10″ or 12″ covers *after* they have been assembled. The die set that controls this precise piercing operation both looks and performs like a "special" made-to-order set. Actually, it is a rear pin catalog set fitted with 1¼″ x 16″ pins. Even with the long guide pins, the highly accurate parallelism is maintained. Yes, Monroe is getting the benefit of a "special" without paying for extras in time and expense.

In all, 12 Producto catalog die sets are used in stamping and forming this assembly. Only the one with the long guide pins is unusual in size or shape but *all* require the utmost in precision and dependability. The point to remember is this: Whether you require a "made-to-order" special or a "quick-to-order" catalog die set, you'll get the *best* from Producto.



FOR PRECISION DIE SETS *FAST* CALL...

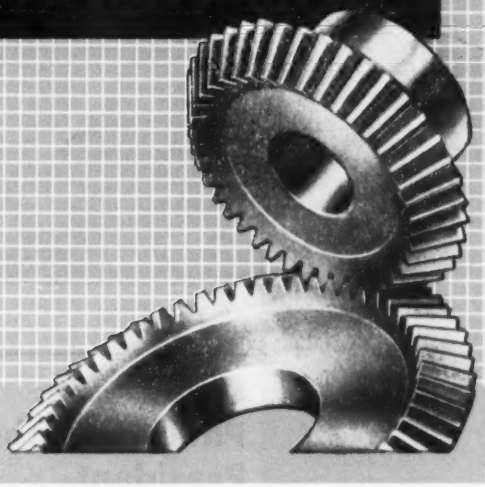
THE PRODUCTO MACHINE COMPANY • 985 Housatonic Ave., Bridgeport 1, Conn.

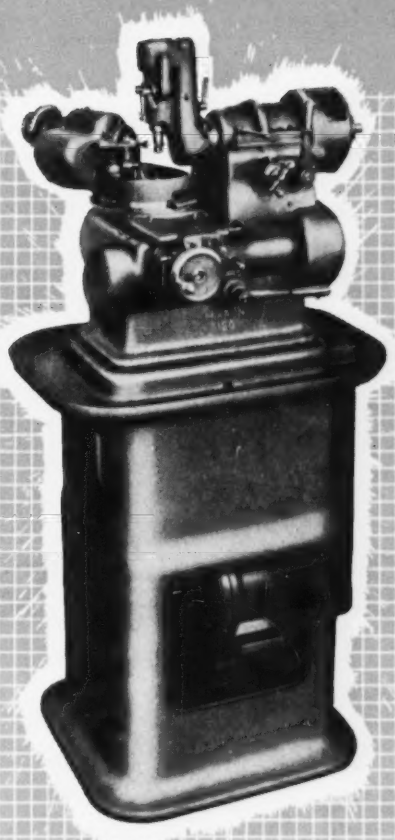
ALSO MAKERS OF DIE ACCESSORIES, FEEDING EQUIPMENT, VISES, MACHINERY. 2PD54A

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THE ULTIMATE IN

BEVEL GEAR ACCURACY





- low-cost tooling
- simplicity of set-up

NO. 120 MIKRON

fine pitch

BEVEL GEAR HOBBING MACHINE

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.



"LONGER TOOL LIFE, BETTER FINISH . . ."

says Philip Rosenberg, President, Howard Industries, Inc., Buffalo, N. Y.

Mr. Rosenberg is talking about *Texaco Cleartex Oil*, used for years as cutting coolant and machine lubricant in a battery of Acme Gridleys producing parts for automotive engines and steering mechanisms. Steel worked ranges from C1016 to 4130. He goes on:

"Texaco Cleartex Oil *has given us complete satisfaction. We get longer tool life, better finish, and our machines are still operating with the original factory bearings. We are glad to recommend* Texaco Cleartex Oil *for similar operations.*"

Texaco Cleartex Oil is just one of the complete line of *Texaco Cutting, Grinding, and Soluble Oils* designed to help you do all your machining better, faster and at lower cost.

A Texaco Lubrication Engineer will gladly help you make the proper selection and improve the machining in your plant. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

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By LORING F. OVERMAN

Flexibility of Military Appropriations Welcomed

INCREASING the flexibility of military appropriations was a popular subject in Washington as Congress headed down the homestretch toward adjournment. The Department of Defense saw in the idea an opportunity to have funds, not too rigidly earmarked, available in time of need for specified general purposes. The Administration appeared to welcome the new flexibility as giving the Department of Defense more leeway in the event that tunes change in various parts of the world.

Congress, too, seemed to favor the idea of making defense appropriations follow broad general patterns, thus passing to the Department of Defense more of the responsibility for military expenditures.

Machine Tool Fund Restored

One result of the discussion of the need for flexibility in military appropriations was the restoration by the Senate Sub-committee of the $250,000,000 machine tool fund originally appropriated for use in the 1954 fiscal year. The House, finding the fund unexpended, voted not to extend the appropriation. If the Senate had not restored the item, the Defense Department would, in effect, have been penalized for its thrifty effort to save the machine tool fund "for a rainy day."

In approving a $28,800,000,000 military appropriations bill (H.R. 8873), the Senate Appropriations Committee restored $177,000,000 cut from the budget by the House. Extension of the $250,000,000 fund for machine tools and production facilities does not represent a new appropriation; rather it authorizes the Services to expend the money previously appropriated for the Vance machine tool and productive facilities program.

Committee Viewpoint Stated

The Committee statement with reference to the machine tool program was: "This amendment would continue the availability of funds which were appropriated for the current fiscal year to provide the Department of Defense with a basis for acquisition and maintenance of machine tools that are urgently needed to be on hand in the industrial mobilization base. Representatives of the Department of Defense presented information to this Committee, which was not available at the time the House considered the bill, indicating a planned program providing for an exhaustive analysis of existing inventories and for the maintenance of machine tools by the so-called packaged-plant method.

"This method, with which the Committee has been in full accord, would provide for the maintenance of tools not in dispersed public warehouses, but in integral units which would contain all the tools for a single plant. The Committee cannot overemphasize the importance of a continuous exhaustive inventory of these tools to determine the degree of obsolescence and to provide for an orderly disposal program since there is little justification for the retention of tools not worth the consequent excessive warehouse costs."

Machine Tool Fort Knox?

Somewhere under the hills of Pennsylvania a huge cave is to be made ready during the coming year to receive some of the vast hoard of machine tools owned by the United States Air Force. During the months ahead, machine tools released from the production lines because of completion or cancellation of contracts will be put into temporary storage if the Pennsylvania facility is not ready. The Air Force would prefer to maintain such tools in the plants of manufacturers, but this is proving impracticable because of waste of production space. Inactive storage near the point of use is considered too costly. The trend, therefore, is toward going underground at central storage points. At such locations, it is planned to store the tools in tagged, ready-for-use packages.

Export Policy Discussed

An export financing policy that will enable United States manufacturers to compete with producers from other lands is a needed step, the Senate Banking Committee was informed by industry spokesmen. These viewpoints were expressed during hearings on the Capehart-Maybank Bill (S. 3589) which would extend and expand the lending program of the Export-Import Bank. Senator Capehart said during the hearings that it is his understanding that Congress intends the Export-Import Bank to include long-term development loans on capital goods as a part of its program.

Both the Machinery and Allied Products Institute and the National Machine Tool Builders' Association endorsed the general purposes of the bill, but felt that its intent should be more clearly outlined by Congress. In addition, the N.M.T.B.A. pointed out that the Export-Import Bank tends to place emphasis on large, coordinated development projects. It was suggested that the Bank give added consideration to ordinary loans to exporters.

AT press time for this column, Senator Saltonstall had introduced a bill (S.3593) to extend the Act of July 17, 1953, Public Law 130 of the 83rd Congress. The law authorizes the armed forces to install machines and equipment in government and private manufacturing plants to expand defense production capacity. The law, scheduled to expire on June 30, 1954, was expected to be passed quickly.

Enactment of the extension bill was requested by Secretary of the Army Stevens. He explained to Congress that it is not possible for the Services to predict as accurately the need for mobilization capacity as it is to forecast the need for facilities on military bases. "Under the existing international situation," he wrote, "the present emergency may become acute at any time without warning. In such an eventuality, time would be a significant factor in the expansion of urgently needed productive capacity."

WASHINGTON is not yet ready to let industry forget the importance of moving essential facilities out of target areas whenever possible, or of protective construction when such movement is impractical. The Office of Defense Mobilization has announced that it will give consideration to applications for rapid tax amortization as a means of helping industry get out of trouble spots.

HARDINGE
ELMIRA, N.Y.

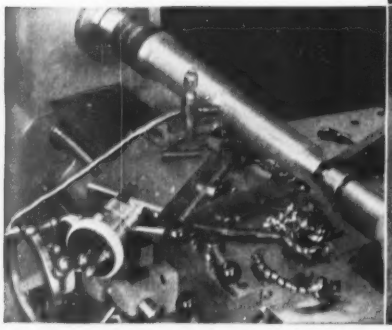
TOOL ROOM LATHE

Features QUICK *Feed Change*

Simply TURN KNOB FOR EXACT FEED REQUIRED



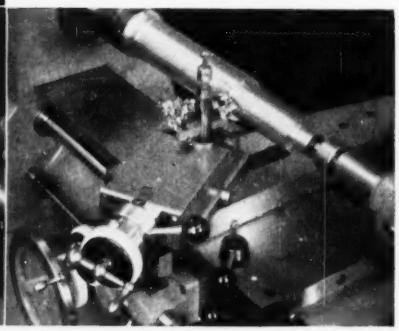
CHANGE FEEDS WITHOUT STOPPING SPINDLE OR CHANGING OR SHIFTING GEARS



COARSE FEED

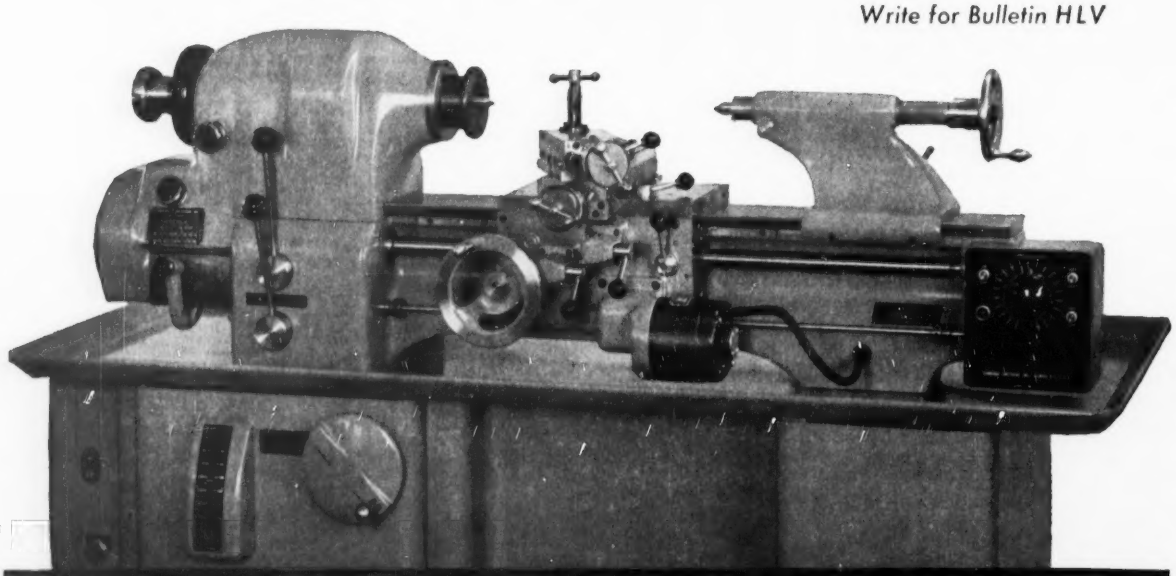


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MACHINERY
AUGUST 1954

Focussed Selling Insures Effective Selling

FOR nearly fifteen years—from the time that World War II started in Europe until a few months ago—little real salesmanship was necessary because of the universal sellers' market that existed. Management's attention was almost completely devoted to production in the attempt to meet insatiable demands. Today, with the return of competitive markets, management is faced with the job of revitalizing selling procedures. Top company executives are keenly aware of the changed conditions.

The need for close study of selling methods and realistic planning of sales programs is present in practically every branch of industry and especially in the market represented by the metal-working industry. This vast industry provides the nation with products ranging from paper clips to automobiles, aircraft, Diesel locomotives, and ocean liners. The total value of its products in 1953 added up to the enormous sum of $95,000,000,000. There are some 54,000 plants and shops in the metal-working industry, employing about 5,750,000 persons, and engaged in the machining, forming, welding, and other processing of parts from raw materials.

To cover the market represented by this aggregation of plants would be a formidable and almost hopeless undertaking were it not for the unique fact that the buying power of the metal-working industry as it relates to production machinery, perishable tools, and raw materials is highly concentrated. Some 3700 plants—only 7 per cent of the total—employ 75 per cent of the employes in the entire industry, or more than 4,000,000 persons.

Even more spectacularly, this 7 per cent of the shops accounts for 84 per cent of the total value added by manufacturing processes to the raw materials that went into the products of the industry last year. The buying power of this small group of plants rates accordingly, even though there may be a considerable amount of variation in individual cases.

For maximum results, the selling efforts of manufacturers of machine tools, presses, perishable tools, and other shop production equipment must be focussed on the relatively small group of plants possessing high buying power. The large number of smaller shops with limited buying power can then be cultivated and, of course, for certain types of standard machines they represent a substantial market.

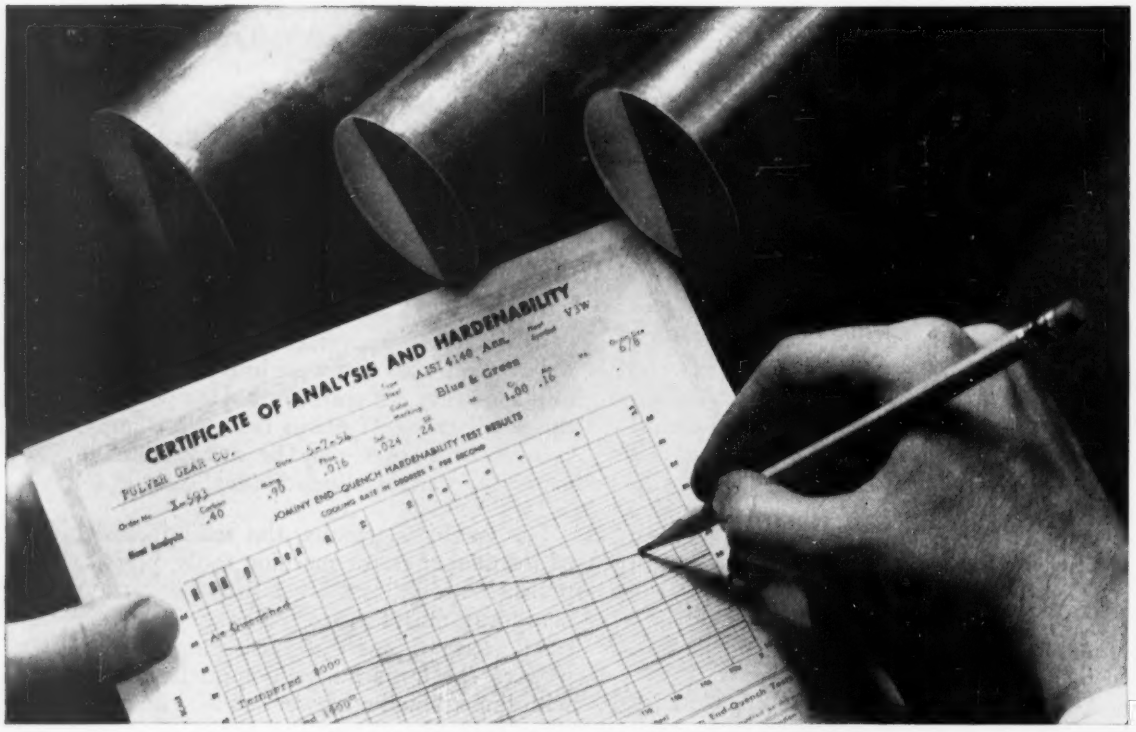
Although the sales problem, when efforts are concentrated primarily on the group of plants having high buying power, is far less difficult than a program covering the 54,000 shops, it is more complicated than may seem at first glance. In the larger manufacturing plants, there are often ten or twenty men who must be continuously cultivated by salesmen, and those who are the most important to a sales representative are the hardest to reach.

Final decisions in equipment buying are invariably made by men whose technical training and experience qualify them to determine what machines and tools will give the best results. Decisions concerning machines and perishable tools are seldom left to the discretion of the purchasing agent.

Successful selling programs are those directed to the plants with highest buying power for the products of the individual equipment manufacturer and also to the technically trained men who give the green light on purchases.

Charles O. Herb

EDITOR



Steel user drops own tests

relies on pre-tested Ryerson alloys

A manufacturer reports that it was standard practice with his company to run a pilot hardenability test on all alloys, regardless of source. But after checking their results over a period of time against Ryerson Certificates of Analysis and Hardenability, they decided that our alloy steel and our Certificates were so completely reliable that the pilot run could be discontinued. The result: a definite saving in time and money.

* * * *

You don't have to run analysis or heat treatment response tests on Ryerson Certified Alloys. You save time and money because these tests are run and recorded for you as a part of the exclusive Ryerson 8-step quality control plan.

Starting with the careful selection and identification of every heat carried in Ryerson stock, this plan assures you of quality steel—steel of known analysis and known performance. It means that tested alloys, racked separately by heats, are accurately prepared to your specification and shipped to you with test data to confirm quality and guide heat treatment.

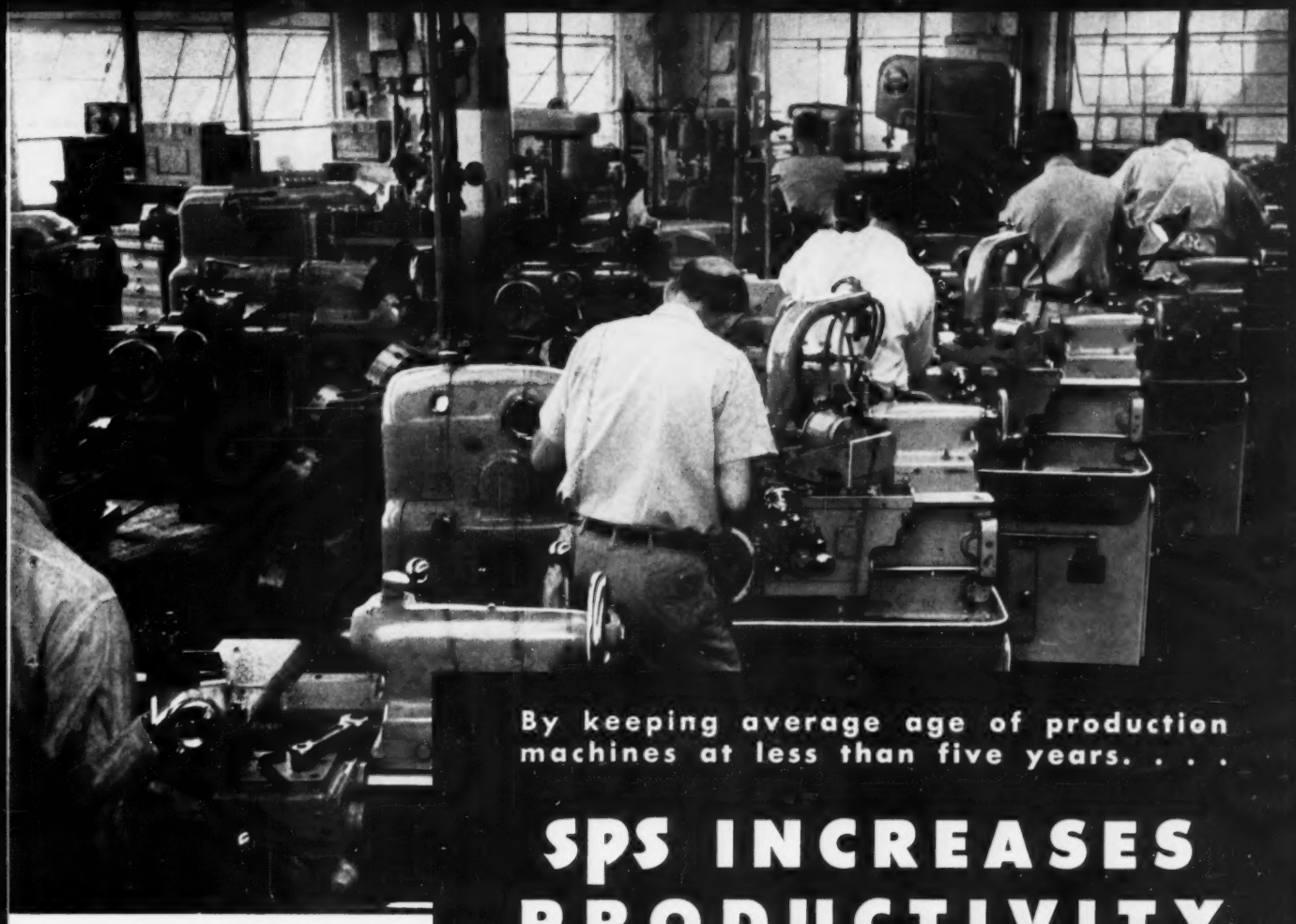
Yes, you save time and money with Ryerson Certified Alloys . . . yet you pay no more. To get these dependable controlled-quality steels promply, call your nearby Ryerson plant.

RYERSON STEEL

Principal products in stock: bars, structurals, plates, sheets, tubing, alloy and stainless steel, reinforcing steel, etc., also machinery and tools.

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By keeping average age of production machines at less than five years. . . .

SPS INCREASES PRODUCTIVITY

By James L. MacDowell
Superintendent of Manufacturing
Fastener Division, Standard Pressed Steel Co.
Jenkintown, Pa.

TO INSURE continued prosperity in a period of increasing competition and rising costs, the Standard Pressed Steel Co., Jenkintown, Pa., has instituted a dynamic capital investment program. By careful, long-range planning and the expenditure of a large percentage of profits for new machine tools, improved equipment, and plant facilities, increased output per man-hour is obtained and better products are manufactured at lower cost.

As an example of the increased productivity being realized from the recently completed $10,000,000 expansion, output per man today is three times what it was in 1946. Although the cost of materials has increased 90 per cent and labor costs have more than doubled since 1942, prices of the company's products are up only 20 per cent. A few products are actually selling for less than in 1942. Also, it is felt that the capital investment program has had a lot to do with the tripling of sales since 1948.

By directing up to 80 per cent of the profits back into the business, the profits are shared with the employes through continued and increased employment, better jobs and higher wages; with the customers through better quality, faster delivery, and reasonable prices; and with the stockholders through increased earnings. Since the cost of capital investment has been decreasing (as the result of lower interest rates) while labor costs have risen, the value of capital as a replacement for labor has increased approximately ten times in the last fifty years. As this trend continues, it becomes more and

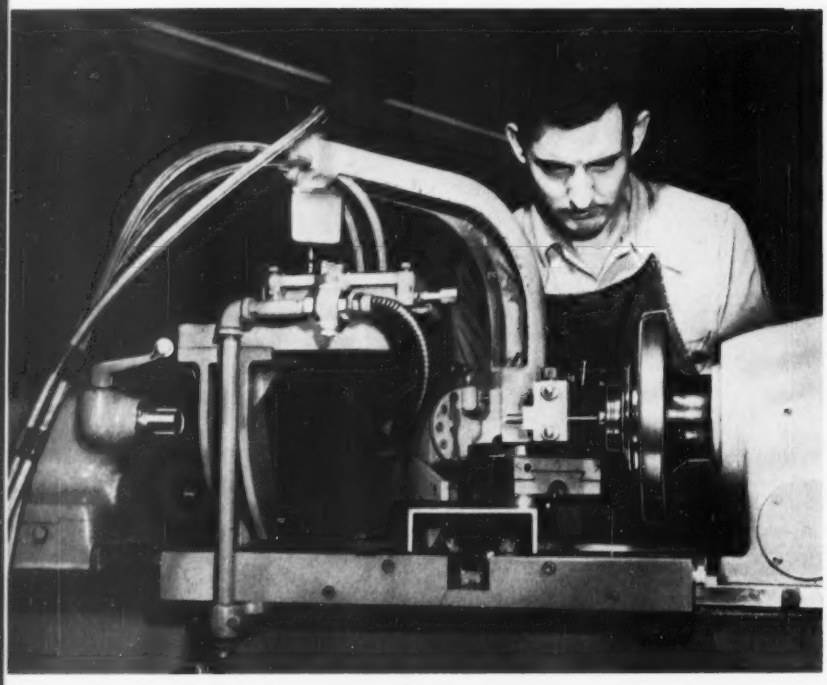


Fig. 1. Tracer lathes facilitate close-tolerance, repetitive work, with production increases up to 25 per cent.

more essential to invest capital in more productive, labor-saving machinery.

An attempt is made to pre-plan the capital investment program from five to ten years in advance. However, machine tools are purchased whenever they are required to perform a new or unusual job or improve the accuracy or quality of the product. Machines are also replaced when it can be shown that they will earn more profit, after deducting all expenses and charges.

At Standard Pressed Steel, most machines are written off (depreciated for tax purposes) in fourteen years. However, an attempt is made to replace most machines in from seven to eight years. Since the primary purpose of machines is to produce, they should be replaced when they stop producing at rated capacity, cannot maintain the required tolerances or quality, require undue maintenance or adjustments, or become obsolete. It is grossly uneconomical to operate a machine at slower feeds and speeds, or only part time, in order to try to prolong its life.

Experience has proved that, in general, new machine tools can outproduce 1945 models by one and one-half to three times, and their output is of higher quality. New machines are run as

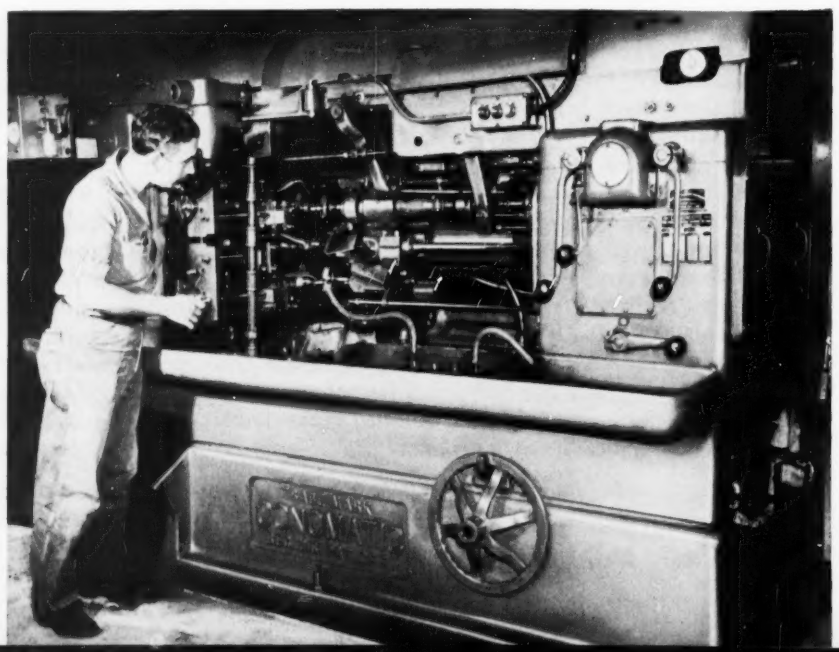


Fig. 2. One of more than 250 modern automatics employed at Standard Pressed Steel to produce a wide variety of products

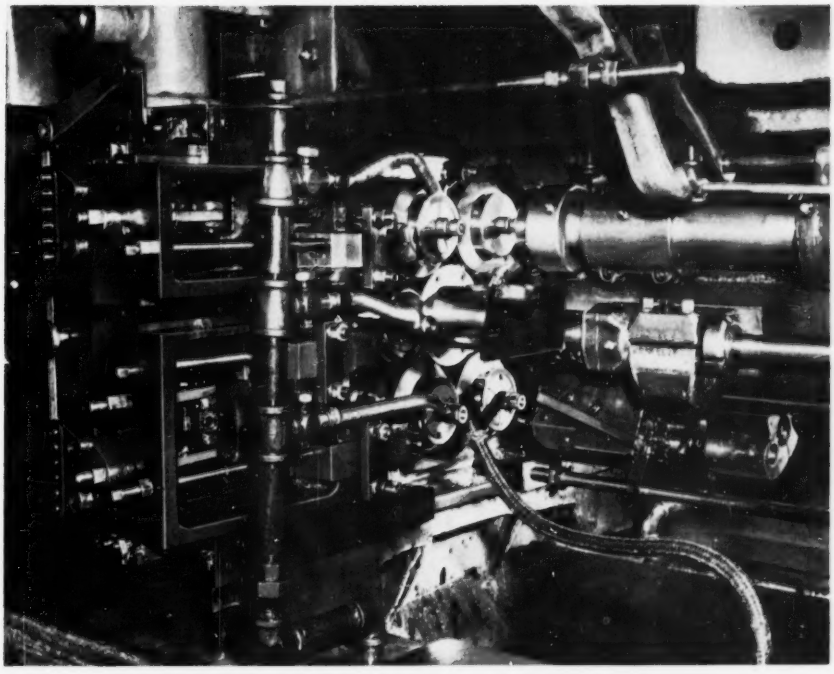


Fig. 3. Close-up view of the tooling area on automatic screw machine illustrated in Fig. 2 shows accessibility of tools for adjustment or replacement.

new machines at SPS. An effort is made to put them by themselves. They are tooled to capacity and operated for maximum production. Current inventories show that the average age of machine tools at Standard Pressed Steel is less than five years, and few are older than eight years. Despite this low average age, present planning calls for 60 per cent replacement of the machines by 1960. Good results have been obtained in disposing of older machines by holding periodic, plant-wide sales.

An example of the modern, high-productive machines employed is the battery of Monarch "Air-Tracer" lathes seen in the heading illustration. These versatile machines are used in the tool-room to turn multiple-diameter shafts, and turn or bore contours to a high degree of accuracy and smooth surface finish. Close-tolerance, repetitive work results from a combination of an air-tracer and a hydraulically operated power circuit, in conjunction with a master template. Average set-up time is less than ten minutes.

Prior to the installation of these tracer lathes, two or three out of every ten parts produced by skilled operators on conventional lathes were rejects. Now, rejects have been eliminated, and

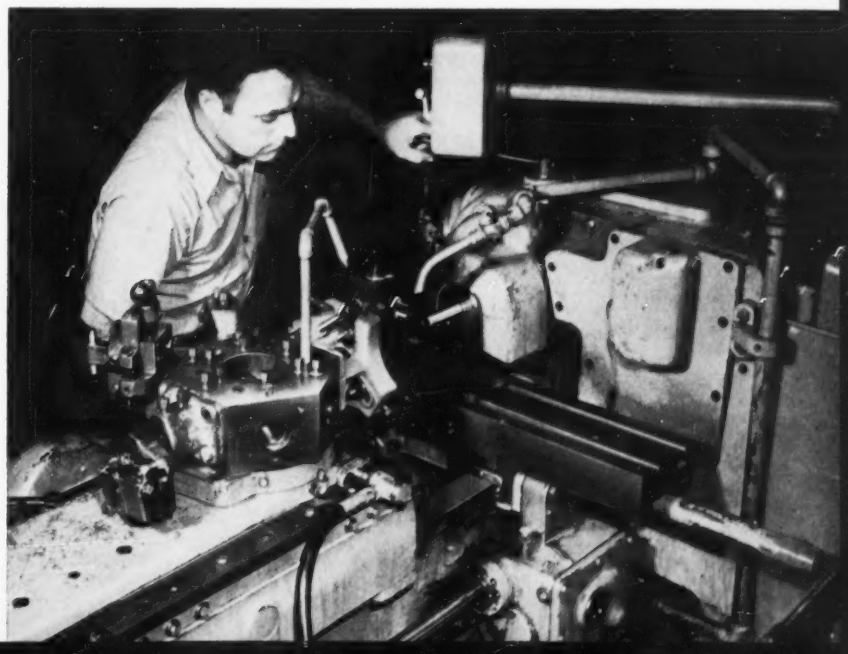


Fig. 4. Increased horsepower of turret lathe makes possible high-velocity turning—with resultant higher production and better finish.

production per man-hour for each machine has been increased approximately 25 per cent. Also, much closer tolerances can be maintained, as the tracer lathes provide automatic sizing. In the set-up illustrated in Fig. 1, a precision screw-forming die is being contour-turned, bored, and faced, maintaining critical dimensions within 0.0005 inch.

Automatic screw machines are a most important production item in the plant, more than 250 being currently in use. By employing the most modern automatics available, such as the Conomatic shown in Fig. 2, production has been increased 25 to 30 per cent. With the large, open tooling area on such machines, shown in Fig. 3, the tools are freely accessible for adjustment or replacement, thus minimizing non-productive "down" time.

Rigid support and accuracy of tool-slides and work-spindles on the automatics permit holding required dimensions as close as 0.0005 inch. Ample power (20 H.P. on 1-inch capacity machines) and the wide range of spindle speeds and feeds available allow full advantage to be taken of carbide tooling for the more effective machining of materials ranging from new high-strength alloys for aircraft to the more machinable non-ferrous alloys. The added flexibility of newer types of machines reduces maintenance problems considerably.

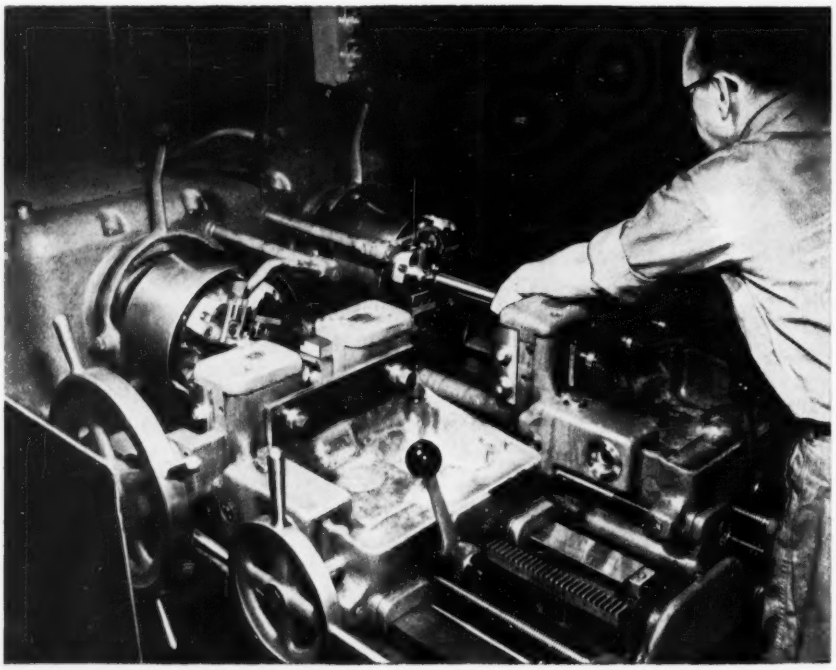


Fig. 5. This double-spindle threading machine is provided with mechanically controlled, positive feed to the lead-screw for improved accuracy.

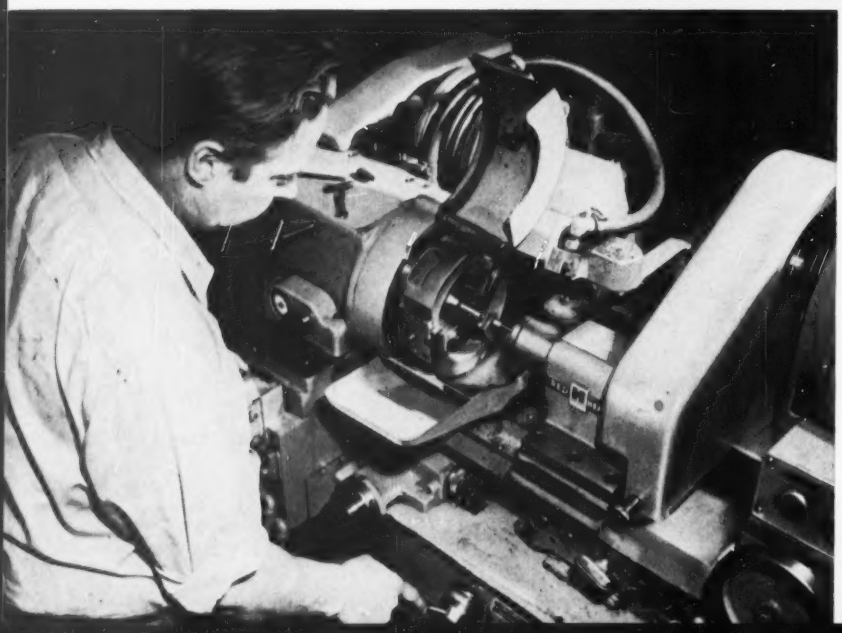


Fig. 6. New machines permit closer tolerances. Here, the bore of a knock-out sleeve is being ground to size within a tolerance of only 0.0003 inch.

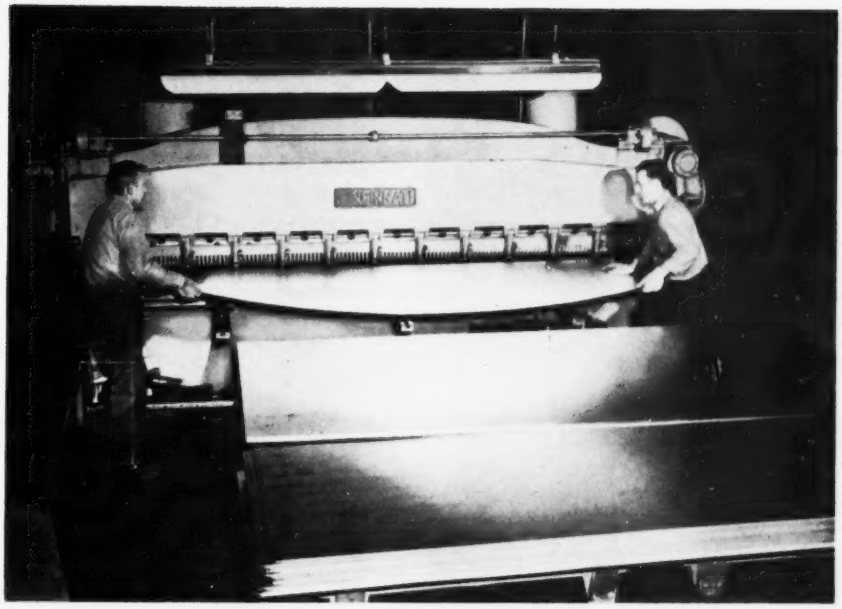


Fig. 7. This shear accurately cuts stock up to 12 feet wide and 1/4 inch thick, without the need for changing the knife clearance for different thicknesses of material.

Also important to the production of a wide variety of parts are the turret lathes. Here too, new, more productive machines, such as the Jones & Lamson turret lathe shown in Fig. 4, have been installed. These machines have up to double the horsepower of earlier models, and permit high-velocity turning, with production increases of 25 per cent or more. Improved accuracies, better surface finishes, and less distortion are obtained with the higher speeds and feeds.

Approximately ten machines are available for every eight operators at Standard Pressed Steel. This surplus of machine power is economical because it is cheaper to shift an operator from one machine to another than to reset a machine for a different job. In the latter case, both the machine "down" time and the idle time of the operator would be non-productive charges. With a surplus of machines, flexibility is possible and adequate production facilities are available for periods of peak demand.

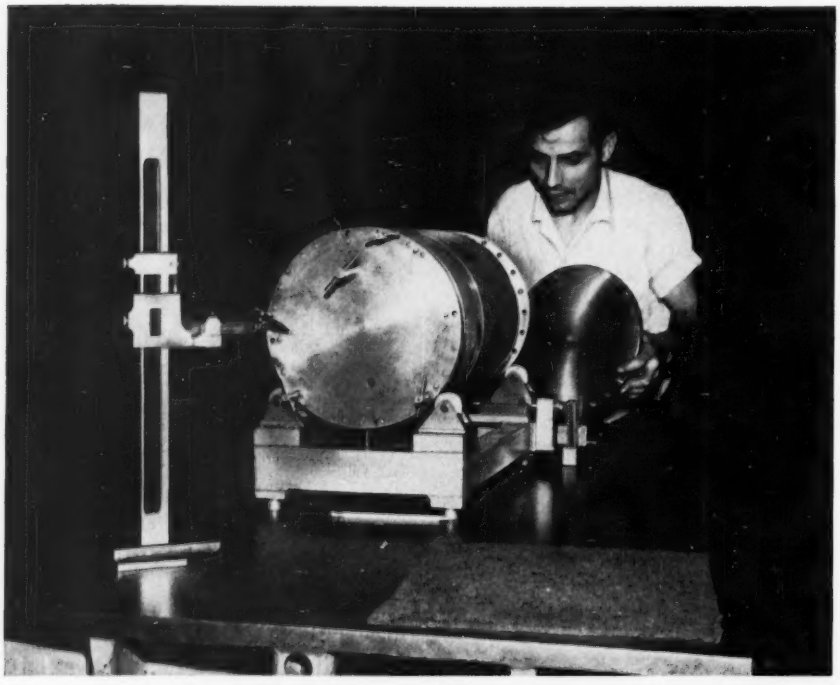
Many difficult and exacting threading operations must be performed in the production of special socket screws and precision bolts. With older threading machines, continual trouble was encountered in maintaining the required tolerances, resulting in considerable machine "down" time, the need for many adjustments, and a high percentage of scrap pieces. One solution was the purchase of a double-spindle threading machine, Fig. 5, made by the Landis Machine Co. With this machine, which has a mechanically controlled, positive feed to the lead-screw, it is possible to thread bolts to tolerances well within those required. Practically no maintenance is required, and long life is obtained. Thread tolerances over the years have become closer and closer in response to demand.

Another example of the procurement of a new machine to obtain superior products is the Heald internal grinder shown in Fig. 6. With existing equipment, which was only eight years old, it was impossible to maintain the specified tolerances. Now, the required accuracies are easily held and production has been boosted from two to three times. In the set-up illustrated, for example, the bore of a knock-out sleeve is being ground to size within a tolerance of only 0.0003 inch.

A final example of the dividends received from the program is the Cincinnati shear seen in Fig. 7. Investigations showed that substantial economies could be effected by cutting large sheets at the plant rather than buying small strips cut to size by the steel supplier. As a result, this shear, which will cut stock up to 12 feet wide and 1/4 inch thick, was purchased. It is unnecessary to change the knife clearance when shearing different thickness materials on this flexible machine. Squareness of the sheets sheared can be accurately maintained, and it has been found that the four edges of the knife blades require grinding only about once a year.

It is hoped that these few illustrations serve to point out the tremendous benefits that can result from a well-planned and dynamic capital investment program. Expenditures for more productive machinery are essential to maintain and expand efficiency in the face of competition. More and better products at lower cost are the end result.

Constructing Pressure Vessels for a Defense Project



By W. R. Miller, Plant Manager
Rheem Mfg. Co.
Downey, Calif.

MANY parts for critical defense projects are made to precise tolerances and rigidly inspected as customary procedure. However, in making a pressure vessel for an important secret weapon at the Rheem Mfg. Co.'s Aircraft Division in Downey, Calif., manufacturing control and inspection are carried out to a point seldom found necessary in mass-production operations. The end use of the pressure vessels cannot be disclosed for security reasons and neither can some of the production methods. Sufficient information can, however, be presented here to indicate the ingenuity that was required to overcome certain manufacturing problems.

The pressure vessel is constructed from three forgings, there being two ends of S A E 4130 steel and a barrel of S A E 4140 steel. Ends for pressure vessels can be seen in the foreground in Fig. 1 and barrels at the rear. These forgings are magnetically inspected when they arrive at the plant, are tested for hardness, and are normalized before entering the manufacturing area. When the forgings have been machined, more than 75 per cent of the original stock has been removed.

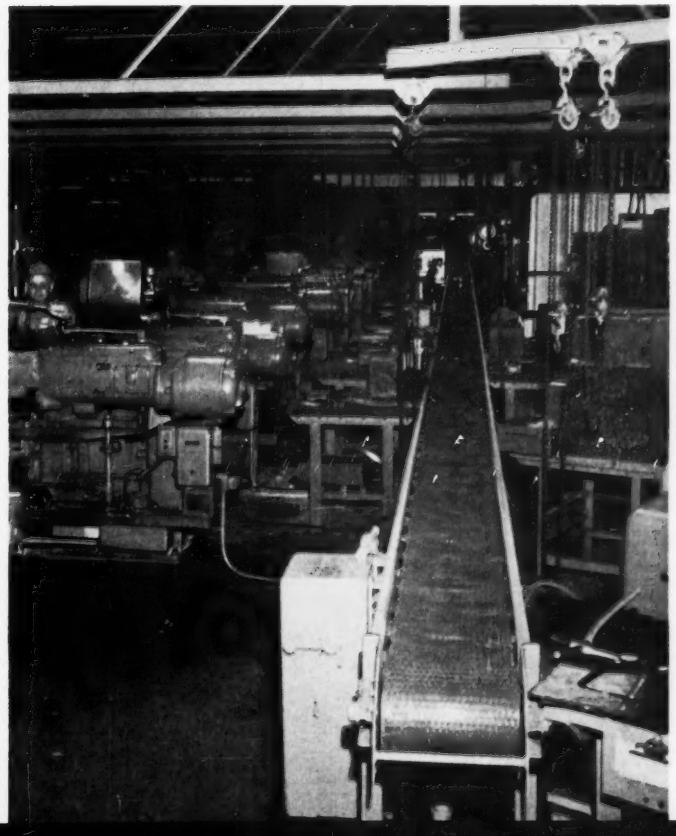
One department in the Rheem plant has been set up especially for this job. Lathes that machine the separate components are conveniently located on both sides of the steel-belt conveyor in Fig. 2, at the head of the production line. As the parts are taken from any lathe, they are placed on the conveyor, delivered to an inspection point for an operational check, and then to lathes and other machines for subsequent operations. The conveyor even carries the workpieces through furnaces. The complete department operates as an integrated unit that receives raw material at one end and delivers finished parts at the opposite end.



Fig. 1. Pressure vessels for a defense project are constructed from two end forgings, such as seen in the foreground, and a forged barrel, such as seen in the background.

The first engine lathes in the production line rough-turn and face the forgings. A typical roughing operation on a pressure vessel end is being performed on an American lathe in Fig. 3. Stock is generally removed to a depth of 0.375 to 0.400 inch at a feed of 0.017 to 0.028 inch. Carbide cutters are used. After each of the four steps in the preparatory machining, the part is placed on the conveyor and carried to an inspection point. When the dimensions have been checked, the part is degreased and magnetically inspected.

Parts that pass these intermediate inspections are placed on pallets and trucked to the head of the lathe line as many times as required. Final cuts on the ends consist of contouring the inside surface and turning the surfaces to fit the barrel. In Fig. 4 is shown an end being turned internally on an Axelson lathe, a template at the back of the machine being employed to guide the cutters according to the desired contour. The tolerances on most of these dimensions are several thousandths of an inch but the mating surfaces of the ends and the barrel must be to size within 0.001 inch, because in the assembly of the three parts, the ends are shrunk over the lips of the barrel.



For this assembly operation, the ends are heated to approximately 400 degrees F. in the fixture shown in Fig. 5. The barrel is accurately seated in a cradle and dowel-located. At the proper moment, the ends, in true alignment, are advanced to the barrel by an air cylinder. The fixture is gas-fired, there being thirty-two jets of flame directed around the periphery of the end. These jets are lighted from an electric spark plug.

With the shrinking of the ends on the barrel, the mating is permanent, and so at this point the three parts become one definite unit. An "Operation Inspection Log" is attached to the vessel, on which detailed statistics concerning every operation and inspection are entered at the time each specific operation is completed, for the information of the prime contractor. This log is signed by every operator and inspector who handles the pressure vessel.

An overhead conveyor next carries the pressure vessel to an oven which preheats the unit preparatory to an operation performed by the Unionmelt welding machine seen in Fig. 6. The oven doors open and close automatically so that

Fig. 2. Conveyors that extend the complete length of the pressure vessel manufacturing line carry parts to all machining, welding, heat-treating, and inspecting operations.

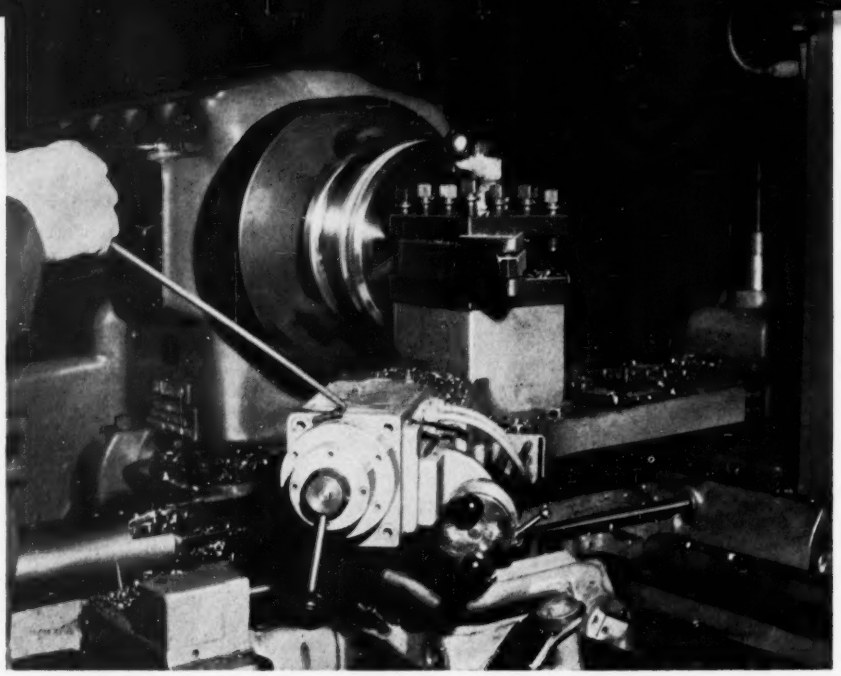


Fig. 3. One of the preliminary lathe operations on the pressure vessel ends from which about 75 per cent of the original stock is removed.

the pressure vessel is not touched by an operator. In the welding operation, two welds are made around the girth of the barrel. The duplex welding head is automatically lowered into position for the operation and similarly raised when the operation has been completed. The number of passes made, the types of electrode and flux used, the amperage and voltage employed, and the actual temperature of the part before welding are all recorded on the log.

An inspection immediately follows the welding operation and then the part is normalized in the special heat-treating fixture in Fig. 7, which relieves the welded areas only. This fixture is provided with two circles of gas jets.

The pressure vessels are then suspended, four at a time, on a rack to be carried into a furnace which performs a heat-treating operation. The pressure vessel is constantly purged on the inside with nitrogen gas during the heat-treatment to keep the inside of the vessel clean from scale. After an oil quench and inspection, the pressure vessels go through another tempering operation and then are permitted to cool. At the end of this step, each pressure vessel must show a tensile strength of from 160,000 to 195,000 pounds per

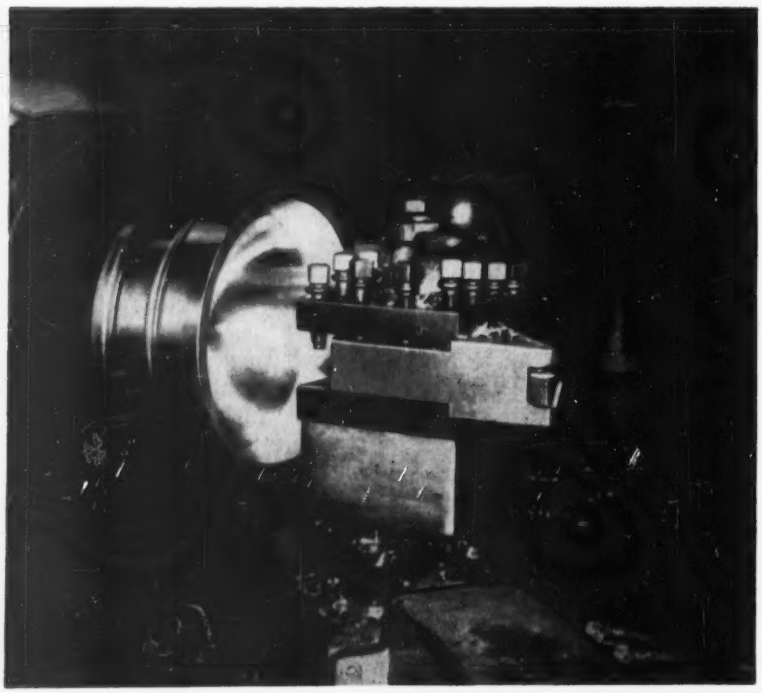


Fig. 4. Turning a dome-like contour in finishing the inside of a head for a pressure vessel

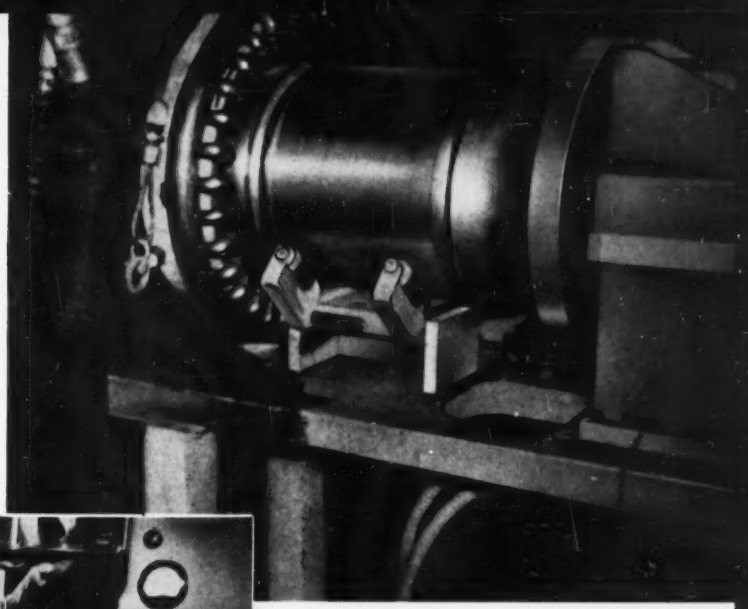


Fig. 5. (Right) The heads of the pressure vessels are shrunk on the barrel after being heated in this gas-fired assembly fixture.

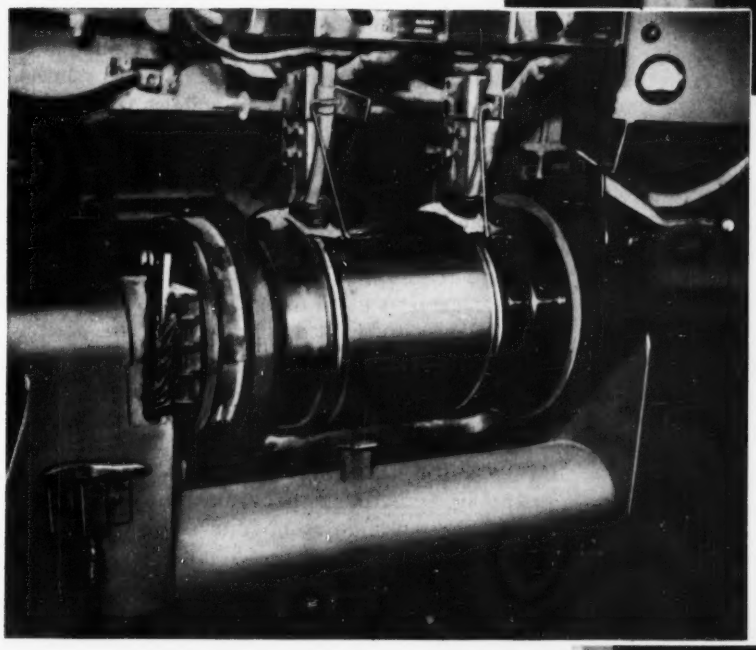


Fig. 6. (Left) The ends of the pressure vessel are secured to the barrel by two circumferential welds made by automatic Unionmelt welding machines.

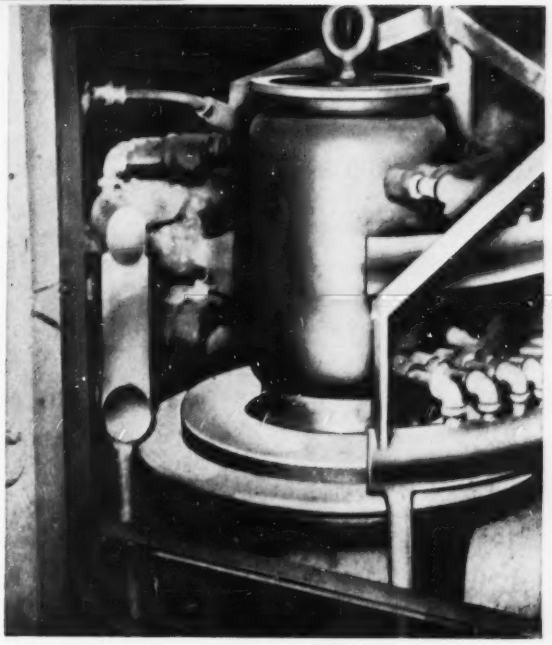


Fig. 7. Another gas-fired fixture which performs a normalizing operation on the circumferential welds produced by submerged-arc welding

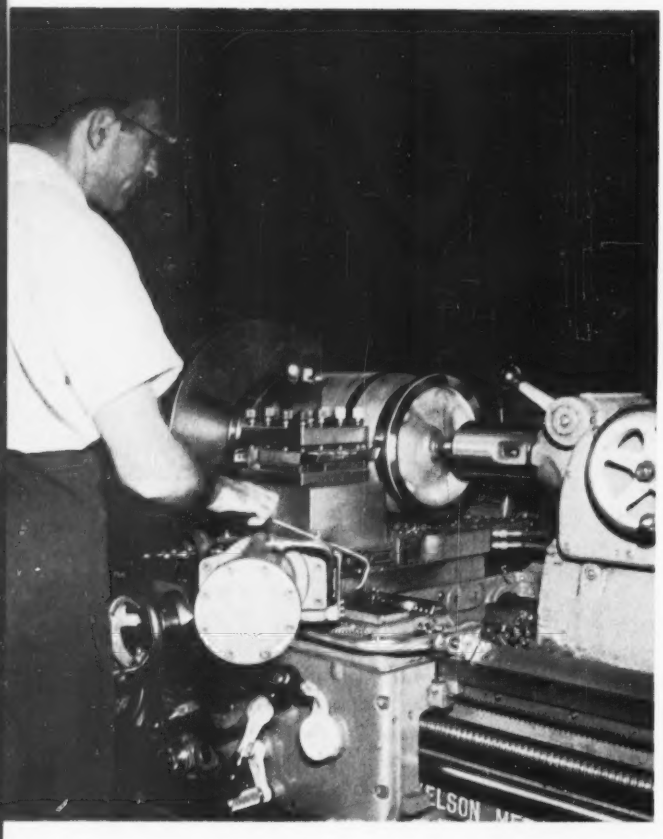


Fig. 8. Finish-facing and turning the end flanges of the pressure vessel and turning the circumferential welds

square inch, at several points. The pressure vessels are next sand-blasted beacuse at this point the outside of the vessels is heavy with scale. Each weld is then X-rayed in four places. The films are developed immediately and checked before the part is released for the magnetic inspection which follows.

From this point, all finishing operations are performed to close tolerances on a production scale. A Fosdick radial drilling machine equipped with a jig performs a series of operations which are severe on drills and taps because of the toughness of the metal. Three lathe operations finish the flanges to final specifications, carbide-tipped tools being used to turn and face the end flanges and turn the welds, as shown in Fig. 8 being performed on an Axelson lathe. Another magnetic inspection follows this operation to make certain that no flaws have been uncovered.

The part is then again inspected dimensionally and for out-of-roundness before going ahead, because succeeding operations consisting of drilling and reaming holes are held within extremely close tolerances as to diameter, center distances, parallelism, and concentricity with the periphery. One of these operations is performed on a double-end multiple-spindle drilling machine, Fig. 9, which was built by the Barnes Drill Co. This machine drills twenty-six holes simultaneously in the flanges of each end.

In Fig. 10 is illustrated a machine constructed in the Rheem shop from four Delta drill heads

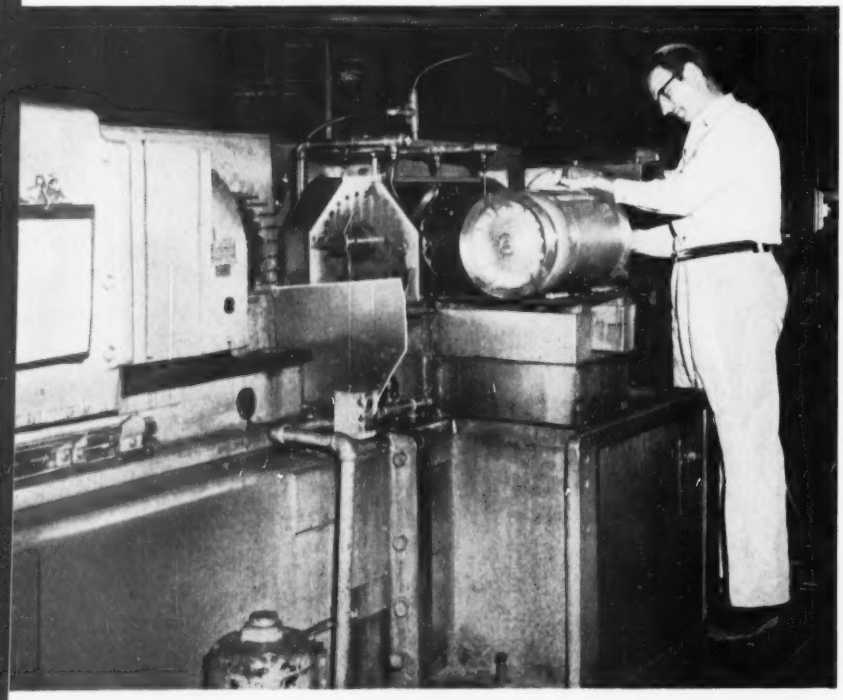


Fig. 9. Double-end drilling machine which produces twenty-six holes in the two flanges of the pressure vessels

for an especially accurate operation in which sixteen holes are drilled around the barrel, four at a time. The accuracy of this machine is checked in detail at the change of each shift. One of the heads is fed hydraulically, the other three by air. A Heald automatic grinding machine produces a finish of 32 micro-inches r.m.s. in a 1-inch hole that must be true to size within 0.0001 inch.

Final inspection of all machining operations is performed on surface plates, as seen in the heading illustration. The unit is again checked for hardness. The part is degreased and hydrostatically tested to double the specified working pressure. This operation is conducted in a booth on the line, after which the pressure vessel is tumbled in an acid bath to remove foreign matter on the interior surfaces and to apply a rust-resistant coating on these surfaces. The pressure vessel is next baked for three hours to relieve hydrogen embrittlement. Subsequently, the part is cleaned, all openings are checked, and tapped holes are inspected for cleanliness. Then comes final inspection.

One pressure vessel is tested to destruction by hydrostatic equipment for every twenty-five vessels made. Destruction seldom occurs under three times the working specifications and rarely happens at the welds. Costly parts from the end of the finished line are hardly ever run in the destruction test. Instead, units are used which were rejected for reasons other than welding defects, somewhere along the manufacturing line.

Cold-Drawing More Economical with Tungsten-Titanium Carbide Mandrels

Drastically reduced mandrel costs, together with elimination of practically all scrap, are being realized at the plant of one of the nation's prominent midwestern fabricators by a switch from chromium-plated steel mandrels to those of tungsten-titanium carbide for cold-drawing seamless steel tubing. The operation, which is performed at 75 feet per minute on an Aetna-Standard cold-drawing bench, consists of reducing 1 1/2-inch diameter by 0.083-inch wall, S A E 1010 steel tubing to 1 5/16-inch diameter with a 0.063-inch wall. When brought to the draw-bench, the tube length is 9 feet 8 inches; after processing, the tube length is 15 feet 9 inches.

The average life of the previously used chromium-plated mandrels, and others made of standard carbide material, was only about 500 feet. Since chromium-plated mandrels cost $2 each, mandrel cost was 40 cents per 100 feet of tubing produced. At last report, the Kennametal Grade K-84 mandrel nib had drawn 440,435 feet at a cost of only 1 1/10 cents per 100 feet.

Since scrap produced with chromium-plated mandrels averaged about 5 per cent, a production of 440,435 feet would have resulted in 22,022 feet of scrap tubing. To date, the carbide nibs have resulted in a savings of $5000. Additional production savings are also obtained as a result of minimized machine "down" time.

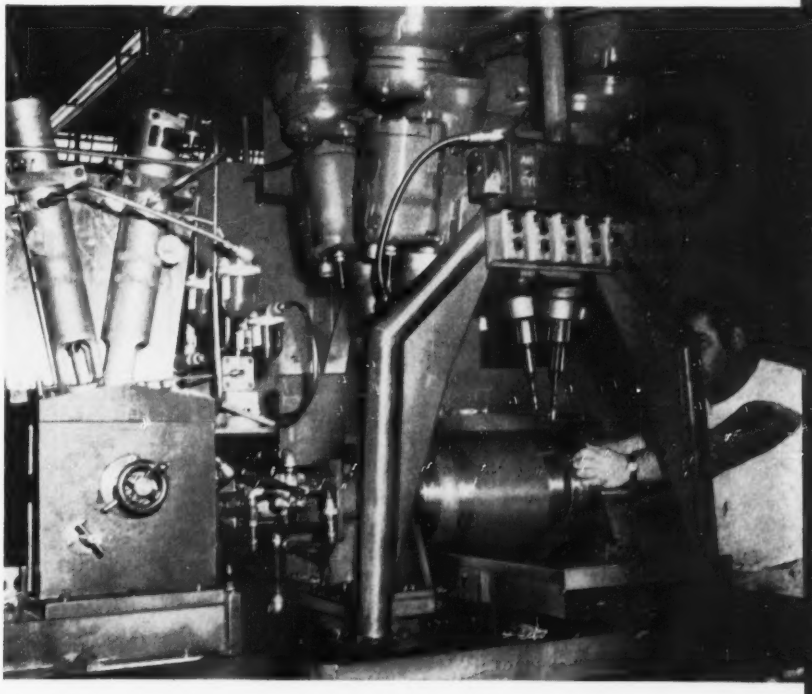


Fig. 10. Unique drilling machine employed for drilling sixteen holes in the pressure vessel barrel, four at a time

Stretching Hot-Rolled Bars Produces Cold-Drawn Properties

By J. A. HELGET, President
Hufford Machine Works Inc.
El Segundo, Calif.

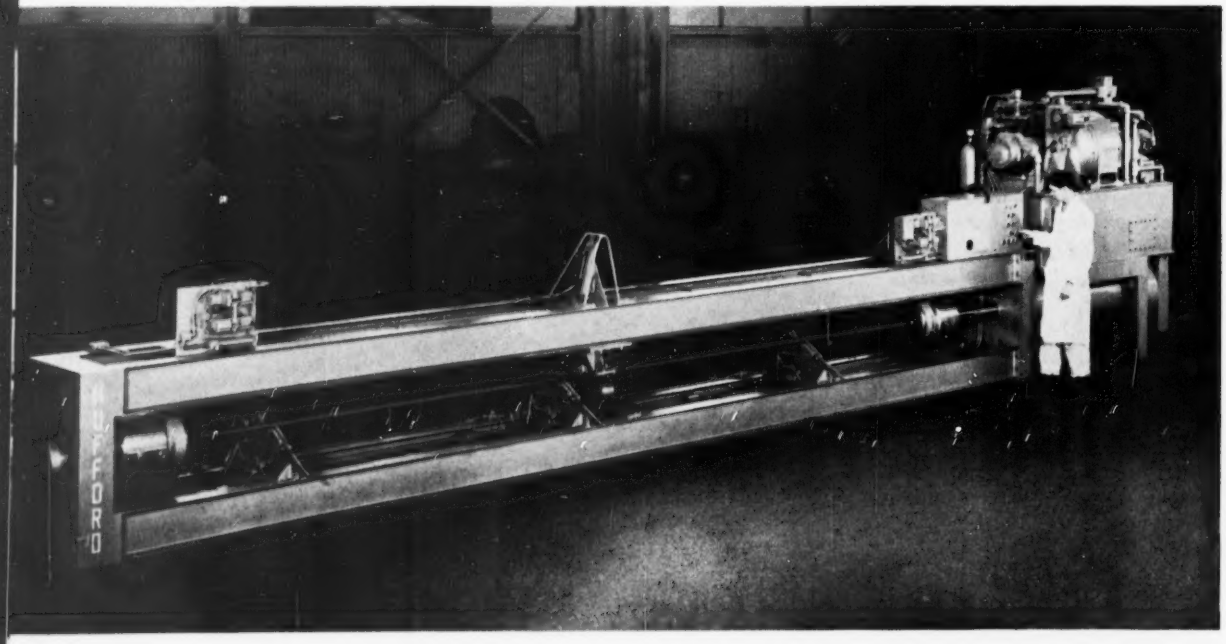
COLD-DRAWING of round steel bars has heretofore been accomplished with draw-bench equipment by reducing hot-rolled stock in dies until the desired size is reached. However, the Hufford Machine Works Inc., El Segundo, Calif., has recently developed a machine which produces the mechanical properties of cold-drawn steel by merely stretching hot-rolled stock. In addition, the operation provides bars of the desired size, accurate throughout their entire length within a few thousandths of an inch. Scale resulting from hot-rolling is loosened so that it can be removed with ease, thus eliminating the necessity of any pickling operations.

In handling 2-inch bars on this machine, which is 20 feet in length, the cost of producing the cold-drawn properties is only about one-tenth the cost involved when conventional equipment and methods are employed. It is believed that the cost of handling bars of other diameters would be approximately in the same proportion. In addition to this economic advantage, the capital investment is much less with the bar-stretching machine than in the case of the equipment ordinarily employed for cold-drawing.

Bars are stretched until their yield point is exceeded, but the stretching is stopped considerably before the ultimate strength point has been reached. The scale that ordinarily adheres to hot-rolled surfaces is cracked and loosened, dropping free of the stock. This scale can be salvaged and used in combination with the metal particles derived from the abrasive belts of the centerless grinding machines employed after stretching, as a source of powdered metal. There is considerable value in the quantities of scale obtained.

A general view of the stretching machine is presented in Fig. 1, a long bar to be stretched being seen between the upper and lower structural members of the machine. The actual

Fig. 1. Hot-rolled steel bars are given the mechanical properties of cold-drawn bars when stretched from 5 to 8 per cent of their length in this machine.



stretch imparted to the steel bar represents an increase in length of from 5 to 8 per cent. Diameters are reduced the same amount over the full length of the bar. Stretching occurs uniformly throughout the cross-section of the bar and results in several advantages in addition to those already mentioned. For example, the machinability of the end product is improved and Rockwell hardness tests have shown uniformity of hardness from the bar periphery to its center.

There are no hard surface skins to impede the action of a cutting tool, and the core is as machinable as the exterior. This eliminates tearing of the metal when machining stock to small diameters or cutting off. Pointing of the bars to enable them to be started through a die is unnecessary, thus avoiding a common steel loss.

Bars assume a straight line between the two ends anchored in the jaws at the opposite ends of the machine, the left-hand jaw being held in a fixed position and the right-hand jaw being mounted on the ram of a hydraulic cylinder. This jaw imparts the pulling action. Because of the yield point being exceeded, there is no tendency of the bar to revert to original bends or curves. Straightness of the stretched bar expedites the grinding operations that follow stretching, and facilitates future thread rolling and similar operations in which the stock must be straight within close limits.

The machine exerts a stretch force of 200 tons. The hydraulic cylinder that actuates the pulling jaw operates at a pressure of 2000 pounds per square inch. The pump that delivers the hydraulic fluid to this cylinder is driven by a 60-H.P. motor and supplies the fluid from a 300-gallon reservoir directly above the cylinder.

Interchangeable inserts can be provided to enable the jaws to handle a range of bars from 2 inches in diameter downward. These removable inserts may be seen in the close-up view of the pulling jaw in Fig. 3. It will be observed that the gripping surfaces of the inserts are knurled. The mouth is tapered to permit easy entrance of the bar into the jaw. The jaw housing can be quickly removed after rotating it a partial turn so as to permit quick change of the inserts.

In the center of each jaw, surrounded by the gripping inserts, is a small hydraulic metering cylinder with a ram that extends to the front of the jaw inserts as seen in Fig. 3. In addition to the support offered by the ram, the pulling jaw is supported by a sling which rides on an overhead track, relieving the ram of some of the jaw weight.

Hydraulic systems of the metering cylinders are coupled to small external cylinders which act as depth gaging devices limiting the length of stock gripped. In operation, the hot-rolled bar drops into the loading position, and the jaw at the right-hand end of the machine advances to center the jaws on the work-piece. The bar forces the metering rams in the jaws to retract within their cylinders. The hydraulic fluid thus dis-

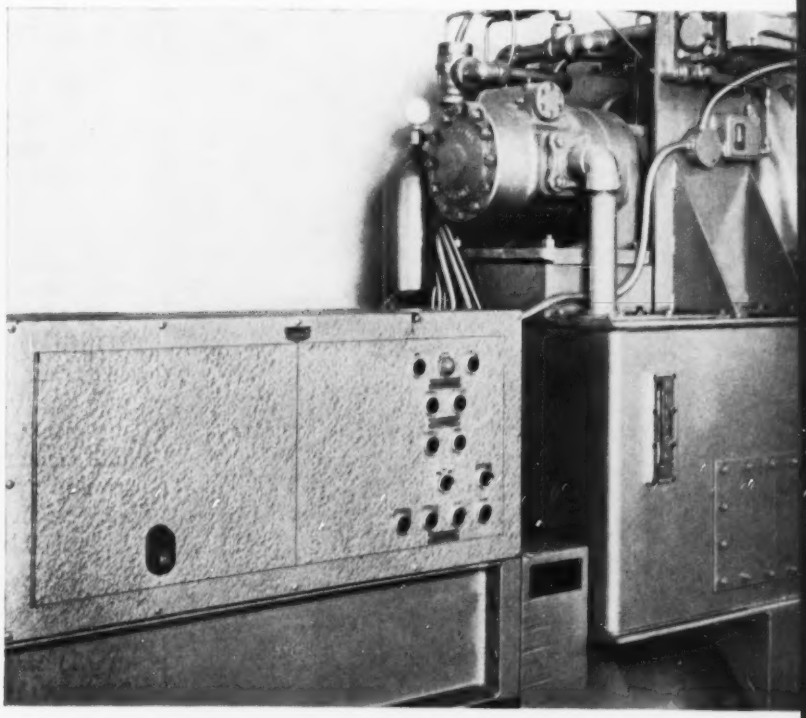


Fig. 2. All controls for the operation of the bar-stretching machine are located at the right-hand end of the machine in close proximity to the pump and reservoir that supply the hydraulic fluid for performing the stretching operation.

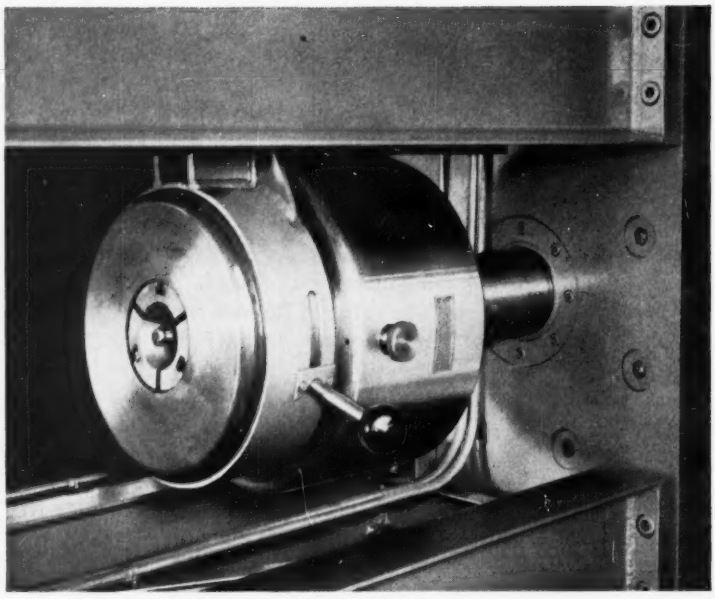


Fig. 3. Close-up view of the pulling jaw, showing the interchangeable gripping inserts and the metering cylinder ram in the center of the inserts.

placed causes the ram of each external cylinder to extend in exact proportion to the retraction of the metering cylinder. The external cylinders trip micro switches which halt extension of the main tension cylinder and close the jaws, thus controlling the length of bar stock gripped. The main cylinder of the machine is then retracted to stretch the bar lengthwise.

With the application of tension, two sizing gages that pivot on arms near the center of the machine, swing around the work to take diameter readings at points 90 degrees from each other. When these GO gages travel across the bar, micro switches are tripped to stop the operation of the machine. One of these gaging devices can be seen in Fig. 4 diagonally above the two top wire brushing wheels. These wheels, individually driven, were provided on the machine to remove any scale at the gaging points and thus insure accurate readings of the stretched bar. Actually, they proved unnecessary because the scale is so effectively removed by the stretching action. They will be eliminated from future machines.

After stretching has been stopped, an unloading button is operated to cause the jaws to open simultaneously, retract the pulling cylinder, and allow the work to fall downward on the rack. An air cylinder then operates to discharge the bar to a finished rack at the front of the machine, from which it is fed to a battery of belt type centerless grinding machines. A bar stretching cycle is completed in about thirty seconds.

In a typical installation, seven abrasive-belt centerless grinding machines would be set up in a line, to receive bars direct from the stretching machine. Each grinder would remove a certain amount of stock until all high spots had been ground away. It is estimated that such an arrangement of equipment would handle 24 tons of hot-rolled bars per eight-hour day.



Fig. 4. Automatic gaging devices adjacent to the wire brushes maintain a close control on the stock size as a bar is stretched.

Unit Engineering of Multiple Drilling and Tapping Equipment

By Melvin H. Emrick, President
Etco Tool Co., Inc., Brooklyn, N. Y.

PRIOR to World War II, relatively few companies were drilling or tapping holes in multiple. This is understandable, as little was then known of the advantages of doing this type of work. Today, there are many parts that lend themselves to this method. Standardization of the multiple-head components, drill and tap-holding chucks, and fixture design account in large measure for the success of the method.

Many parts for instruments, adding machines, fire extinguishers, cameras, electrical equipment, and the fancy grilles on our present-day automobiles are suitable for multiple drilling and tapping. The part can have up to a dozen or more holes and be drilled or tapped in sizes ranging from small number sizes to fractional sizes, and spaced anywhere from 1/8 inch to 12 or more inches apart.

Small-hole multiple drilling and tapping are delicate operations requiring exactness in designing not only the multiple head and chucks, but most important, the fixture. The importance of fixture design cannot be overemphasized. A multiple head, no matter how carefully it is designed and built, is useless without due consideration being given to the method of handling and locating the work. Contrary to general impressions, the design of the head and location of the spindles follow the lay-out and design of the fixture. For better results and ease of operation, the head and fixture should be designed with "unit engineering" principles, to provide a complete integral unit.

Fixture design is also influenced by the type of machine to be employed—for instance, a hand-operated drill press; a semi-automatic foot-operated tapping machine; a push-button controlled, fully automatic drilling or tapping machine; or an automatic lead-screw tapping machine. A good rule is "The longer the run, the more automatic the operation should be."

A simple example of unit engineering is the six-spindle multiple drilling unit shown in Fig. 1. In this illustration, the drill head is in the down position, with the bushing plate clamping the work and guiding the drills. Upon raising the drill head (to which the bushing plate is attached), the work is automatically unclamped and may be removed from the hardened-steel locating stud which is pressed into the cast-iron baseplate. Standard components of the unit—the drill head, bushing plate, and baseplate—are tied together like a punch and die with four hardened-steel rods for accurate alignment.

The three-spindle multiple unit seen in Fig. 2 shows the necessity of unit engineering as applied to tapping. A standard tapping faceplate, to which the multiple head is bolted, controls the forward and reversing direction of the two No. 0-80 pitch taps. The third spindle, rotating at half the speed of the taps, drives a 40 pitch

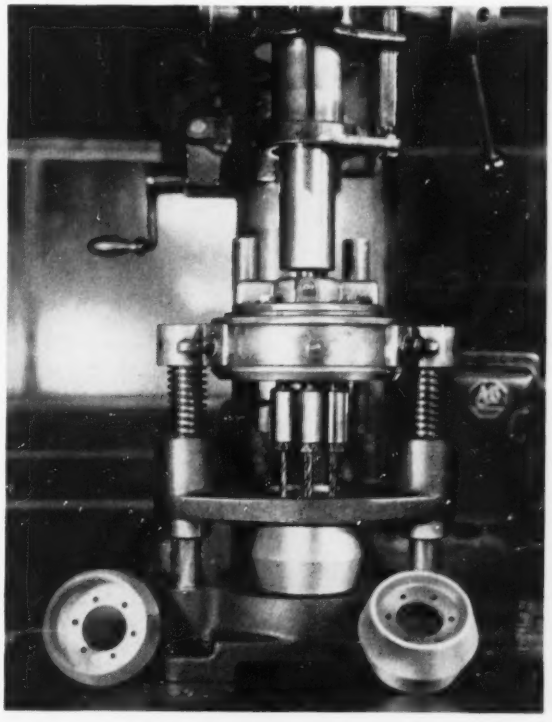


Fig. 1. Bushing plate attached to drill head automatically clamps work-piece in this six-spindle multiple drilling set-up.

lead-screw. This arrangement protects the taps from any end pressures and enables them to cut 1/2 inch deep into the aluminum part while producing the required Class 3 fit.

The fixture and adjustable lead nut are doweled and bolted to the baseplate containing the guide rods. Jig boring of the multiple-head case, fixture, and bedplate results in perfect alignment and squareness necessary to do this class of tapping. Although the method and parts are standard, they have been designed to the requirements of the work in a complete integrated unit. A standard drill press is all that is required for the operation of this unit.

Die cutting of 1/4-20 threads on the three studs of an aluminum die-casting is accomplished smoothly and safely by means of the set-up seen in Fig. 3. For this operation, a standard hand-operated shuttle fixture, a three-spindle multiple head, a tapping faceplate, and an electric air-operated drilling or tapping machine are employed. The work is placed into a nest on the movable table, which is then pushed under the strippers and threading dies as shown. Just before the table completes its "in" stroke, it contacts a micro switch that starts the three-spindle head on its downward stroke.

When the proper depth is reached, the head automatically reverses and returns to its starting position. A pick-up rod extending from the multiple head accurately positions and holds the movable table during the cutting of the threads. Many parts of various shapes can be drilled, tapped, reamed, or chamfered in this way.

Three multiple heads are employed to tap sixteen holes in one part with the set-up seen in Fig. 4. For this installation, three baseplates were accurately spaced on two steel parallels. The curved die-cast aluminum part, which is 32 inches long, is correctly positioned by adjustable supports, stops, and strippers. Each multiple head is held in alignment by its own guide rods, and driven by its own tapping faceplate. Quill clamps are used as a safety measure to prevent the heads from dropping out of the drill press spindles.

The spindles of the press are arranged to have the same center distance as the multiple heads. The tap chucks allow the No. 10-24 taps to float, thus compensating for any variation in center distances between holes in different castings. Also, the chucks have a simple adjustment for maintaining the proper depth of each hole. This is a good example of standard equipment being the answer to a difficult tapping job. Each drill press spindle can be operated by

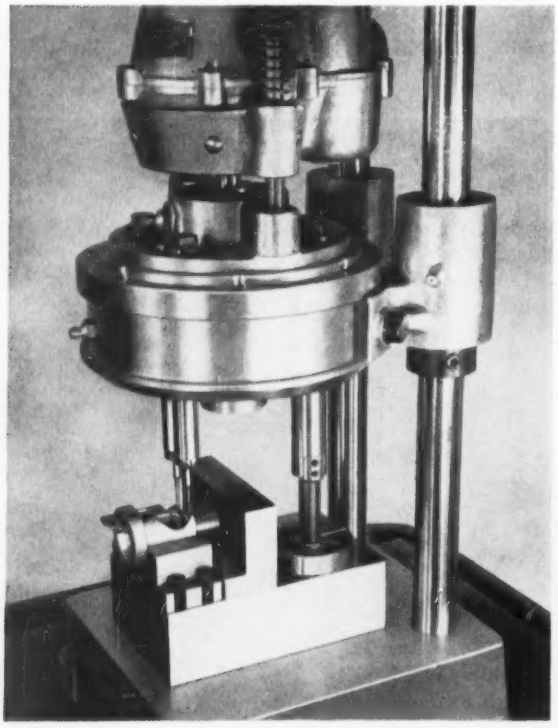


Fig. 2. In this three-spindle unit, only two spindles are employed for tapping, while the third drives a lead-screw.

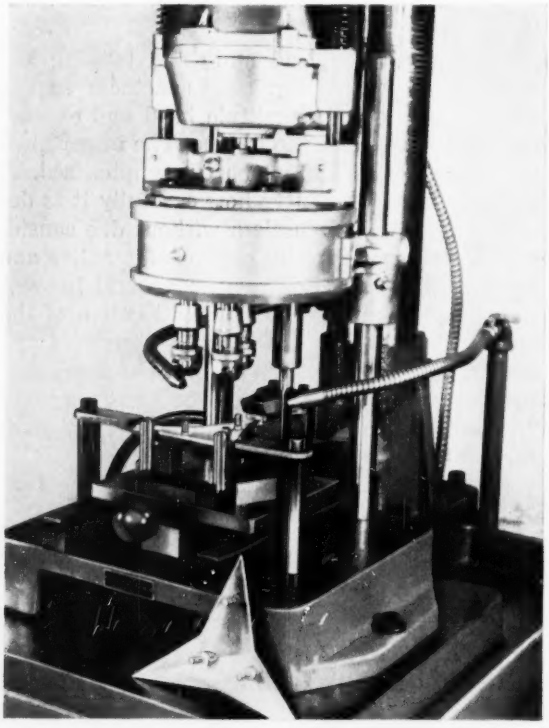


Fig. 3. Threading three studs of an aluminum die-casting. Hand-operated shuttle fixture facilitates loading of work.

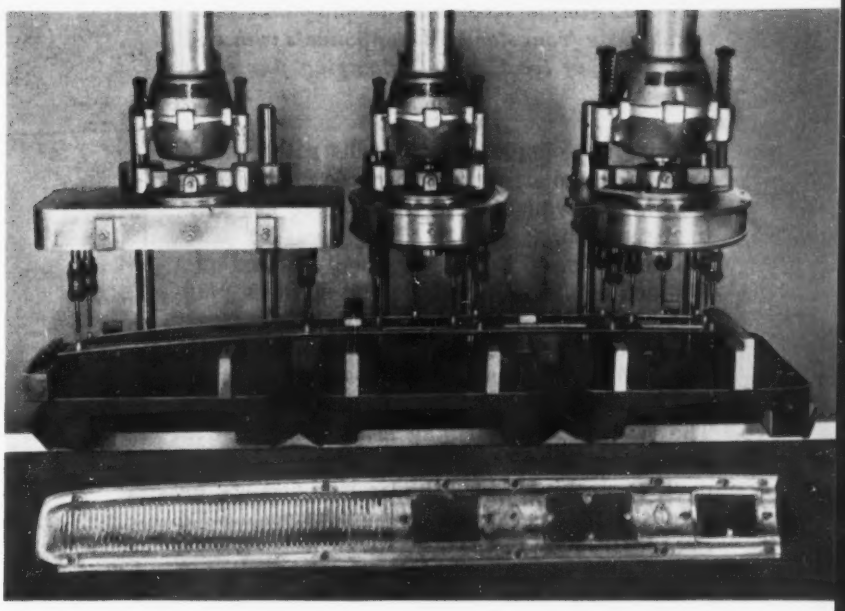


Fig. 4. Sixteen holes are tapped in a long aluminum die-casting by means of three standard heads spaced along two parallels.

hand or by some type of power feed so that all the holes can be tapped by pushing a lever or an electric button.

Drilling of four holes in four parts while locating four more parts in additional stations provided on a shuttle fixture is the cost-cutting practice illustrated in Fig. 5. The eight-station fixture and four-spindle drilling head are mounted on an automatic drilling and tapping machine. Moving the shuttle fixture to the extreme right or left automatically starts the drilling cycle. As is standard practice, the fixture is mounted on a bedplate containing the two guide rods that align the drilling head. The head has a pick-up rod that aligns the fixture. All parts of the unit were jig bored to insure correct location of the drilled hole in the work.

This simple work-piece containing only one drilled hole clearly illustrates the need for good tool design. The resulting tool enables the operator to unload and load the parts as fast as the multiple head can drill the holes. The use of multiple heads is impractical without due consideration being given to methods of handling and locating the work.

The simplicity of designing a six-spindle tapping unit when using standard components is exemplified in Fig. 6. After deciding how to locate and hold the part, a standard bedplate with guide rods can be selected from many commercially available sizes. The correct type and size tap chucks, spindle gears, bearings, and tapping faceplate can also be selected from several standards. The use of standard components accounts in large measure for successful and profitable multiple tapping operations even though the op-

Fig. 5. Eight-station shuttle fixture and four-spindle drilling head permit drilling four parts while loading four more.

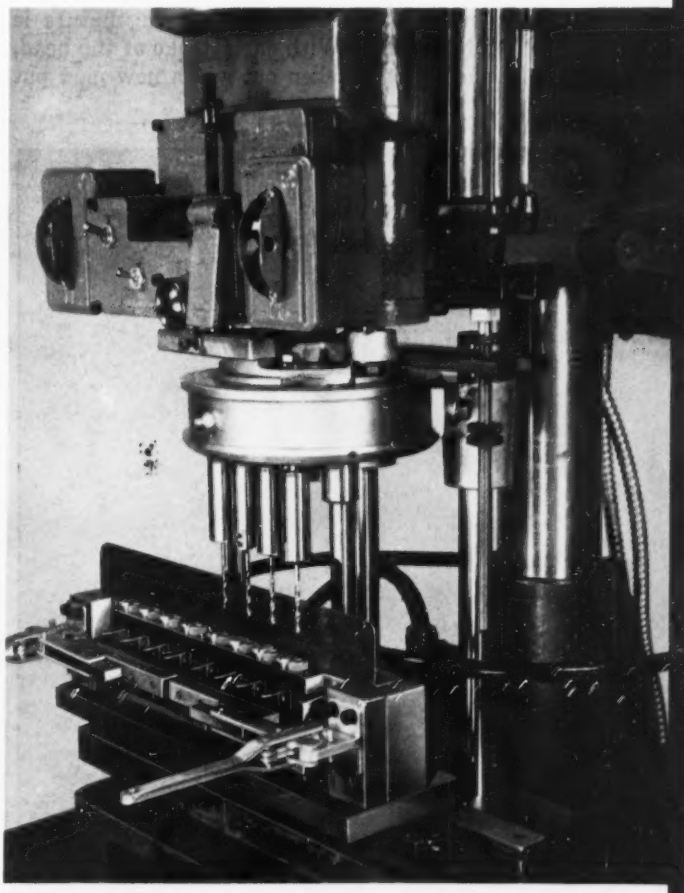


Fig. 6. Simple six-spindle tapping unit that was made from standard components with exception of locating and clamping fixture.

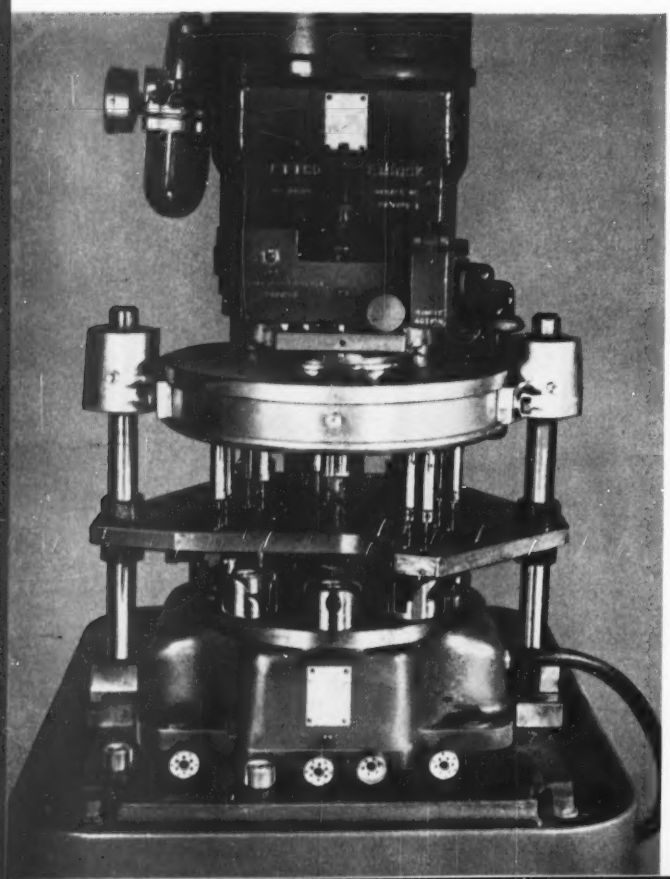


erations are simple and the runs rather short. There are also standard adjustable multiple tapping heads available which add more flexibility to the system.

Twelve No. 45 holes—six equally spaced on a 5/8-inch diameter bolt circle and six on a 9/16-inch circle—are drilled in a part slightly larger than a quarter with the set-up seen in Fig. 7. For high production, an eight-station, electrically operated work-indexing fixture is employed. The twelve-spindle drilling head equipped with a bushing plate is mounted on an automatic drilling machine. Since the twelve holes are too close together to permit good gearing and bearing construction in the head for drilling all holes in one part in one pass, two opposing holes are drilled in the part in six of the eight indexing stations.

In operation, a work-piece is placed into either of the two open stations and held in place by a thumb-screw. The indexing plate moves to the next station when the operator presses an electric button. The head automatically drills twelve holes in six parts after the indexing fixture is locked in position. With each stroke of the head, a finished part is taken out and a new part put in the fixture. The automatic cycle and electric interlocking system make it easy and safe for the operator to produce the required amount of parts. Jig boring of the components and rigid alignment permit the parts to be held within the required tolerances.

Unit engineering of all components together —rather than the individual design of the head, chucks, fixture, or machine—is responsible for the success of the methods of drilling or tapping holes that have been described. Each component must do its part successfully under repeated operation if it is to meet the customer's expectations.



* * *

Electronic Protection for Press Operators

Wristbands which carry radium crystals on a lead-backed, pure nickel disc are a new protective device for punch press operators. Weak gamma radiation from the radium is picked up by special electronic tubes that shut the machine off even in the middle of a stroke when the wristband wearer's hands approach.

Fig. 7. Twelve small closely spaced holes are rapidly drilled in a part by means of an eight-station indexing fixture and a twelve-spindle head.

Central Coolant Supply Serviced by Coarse-Screen Filter

Metal chips, grinding sludge, and similar solids are removed from central coolant supply by a self-cleaning filter requiring little or no maintenance. Long coolant life and the elimination of a stand-by filter are additional advantages

By JOHN W. FAUVER

CENTRAL coolant systems are today an accepted means of supplying entire banks of machines with a uniform coolant mixture at a constant pressure without the cost and installation of numerous individual pumping and filtering units. Among the benefits associated with this type of system are a substantial reduction in the man-hours previously allotted to cleaning out individual machine sumps, a more consistent product finish, and a sharp decrease in coolant replacement costs.

In the grinding department of the Bower Roller Bearing Co., Detroit, Mich., a system supplies coolant at the rate of 1200 gallons per minute to a bank of grinding machines. The coolant is delivered at a pressure of 25 pounds per square inch. A water and soluble-oil coolant mixed in the ratio of 45 to 1 is used on workpieces of S A E 4620 and S A E 52100 steels. Finishes averaging from 10 to 12 micro-inches r.m.s. are required.

The coolant system is based on the application of a Flo-Klean filter manufactured by the Cuno Engineering Corporation, Meriden, Conn. A cutaway photograph of the filter may be seen in Fig. 1. The filtering element consists of a stationary cylindrical cage *A*, the outer surface of which is cut with a screw thread and wound with round wire *B*. The spacing between the turns of wire, on which is based the degree of filtration, is determined by the difference between the pitch of the screw thread and the diameter of the wire. Spacing for this application was 0.005 inch.

Fluid containing grinding swarf and other foreign matter enters the space surrounding the filter element through pipe *C*, where it is distributed by baffle *D*, and circulates throughout chamber *E*. The coolant flows radially inward between the wires, depositing on them all solids too coarse to pass through. Pressure drop is exceptionally low because the fluid flows in a straight line, encountering only a momentary restriction when passing through the wires. From the interior of the element the filtered fluid passes downward to outlet connection *F*.

Continuous cleaning of the filter element is maintained by means of a small booster pump *G* and a backwash nozzle *H*. The booster pump (also called a backwash pump) draws a small portion of the filtered coolant from the outlet connection and delivers it, at a slightly elevated pressure, to the slowly rotating nozzle *H* within the element. This nozzle makes approximately

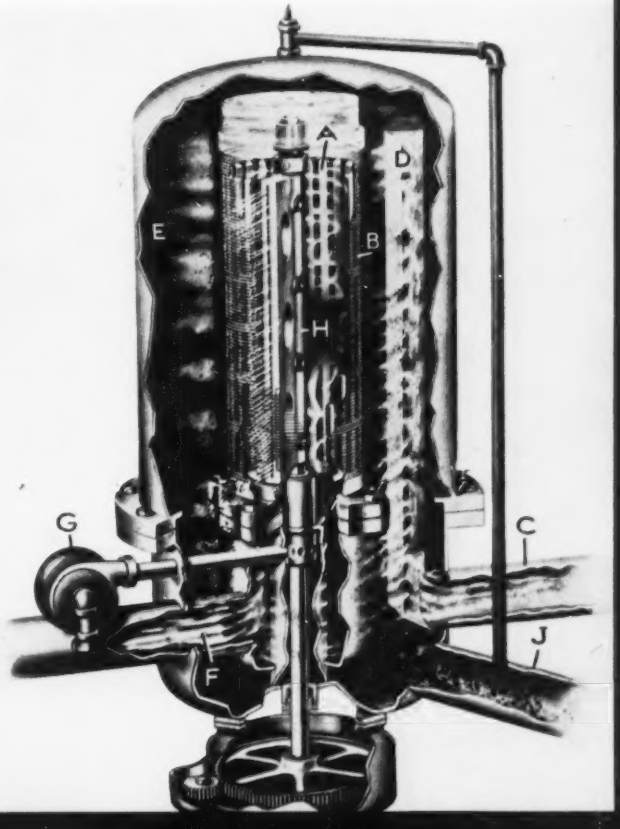


Fig. 1. Filter employed in the coolant system which serves a battery of machines that rough- and finish-grind races for bearings



Fig. 2. Coolant is channeled in vee type trenches from the machines to a settling tank. The floor-plate has been removed to show the trench construction and the appearance of the swarf.

one revolution each minute; therefore any given section of the filter cartridge is cleaned once each minute. Between cleaning periods there is a build-up of foreign matter on the cartridge which serves as an additional filtering medium.

As each section of the cartridge encounters a momentary reversal of flow, all solids are dislodged and the backwash is returned to the system. The heavier solids settle in the base and are periodically drained through an air-actuated, fully automatic blow-off valve. Floating sludge is simultaneously removed by means of a top blow-down arrangement which returns it to a settling tank through pipe *J*. No coolant is lost during any of these phases of operation.

In normal shop procedure, the flow of coolant from the machines to the filter follows a definite cycle. After picking up metal particles from the work being machined, the slurry drains into floor trenches having a V-shaped bottom. This design provides higher velocities at the bottom of the trench, thus reducing the possibility of sediment build-up. Experience has shown that dirt will definitely settle out unless sufficient fluid velocities are maintained through suitable pitch of the trenches. These velocities should range from 7 to 10 feet per second.

The trenches are covered with sections of boiler plate, Fig. 2, which can easily be removed for cleaning out the trenches should this become necessary. A clean coolant line is run to the head of each trench, providing initial coolant at a high velocity to clean out the trench of the first machines in line. Dirty coolant flows into the settling tank by gravity. A heavy grate perforated with 2-inch diameter openings protects the en-

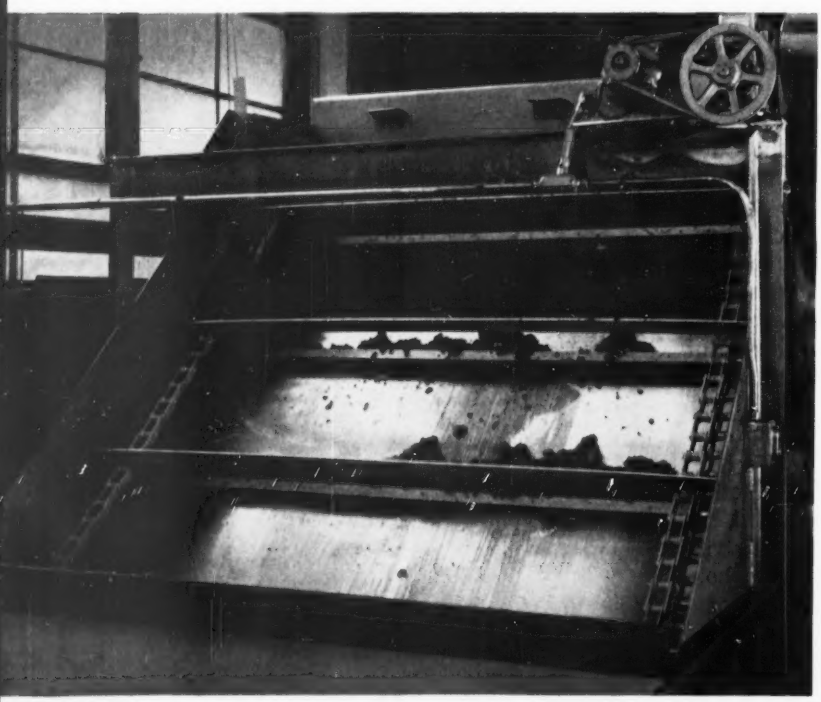


Fig. 3. Flight conveyor that continuously drags sediment from bottom of settling tank and dumps it into containers. Every four hours a fork lift-truck replaces the full containers with empty ones.

trance to the settling tank. This easily removable grating catches all rags, paper, and other such articles that might cause failure of the system if allowed to enter the tank.

After passing through the grating, the dirty coolant flows downward to the bottom of the settling tank where it travels under a baffle. The flow set up by the baffle is such that the heavier foreign particles are thrown to the bottom. Turbulence is prevented in that part of the tank where settling takes place.

Traveling the whole length of the tank bottom, and extending across its entire width as well, is a flight conveyor, Fig. 3, which drags all the sediment up an incline and then dumps it into containers. These containers, Fig. 4, are picked up by fork lift-trucks every four hours and replaced by empty ones. At the left-hand side in this illustration may be seen the filter unit. Below the floor-plates is the settling tank.

As previously mentioned, the floating sludge is blown down from the top of the filter. It is then piped to the dirty end of the settling tank where it is manifolded and directed in such a way as to skim the surface of the coolant. This skimming action drives the floating material into the flights of the conveyor as they leave the fluid.

From the settling tank the coolant is delivered to the filter by a centrifugal pump driven by a 20-H.P. motor. Actually two pumps are installed, one doing the pumping and the other serving as a stand-by unit. After being filtered, the coolant flows through overhead piping to each machine.

Extrusion of Aluminum Studied by Radioactive Tracers

Radioactive tracers are being used by the Aluminum Company of America as a new tool in research studies. Alcoa researchers are using the tracers in lubricant evaluation, analytical chemistry, alloy development, studies of metal flow during the extrusion process and of corrosion resistance, and many other projects.

Radioactive tracers are usually tiny bits of material made radioactive by the Atomic Energy Commission at Oak Ridge, Tenn. This material is then mixed, alloyed, or combined with materials to be tested. By using these tracers, scientists are now able to determine the detailed characteristics of the flow of any small regions of an ingot in the extrusion process.

In order to study the flow pattern, tiny pieces of aluminum alloy made radioactive in the pile at Oak Ridge are placed into holes drilled in the ingot. This ingot is homogeneous since the radioactive alloy does not differ in any chemical or metallurgical respect from the remainder of the ingot. After the ingot is extruded, the flow of metal from the regions "tagged" by the thread of radioactive material can be accurately established by measuring the activity of extruded sections with a Geiger counter. Exact location of the thread can be established by placing a cross-section of the extruded part on a photographic film so that the part will actually take its own picture.

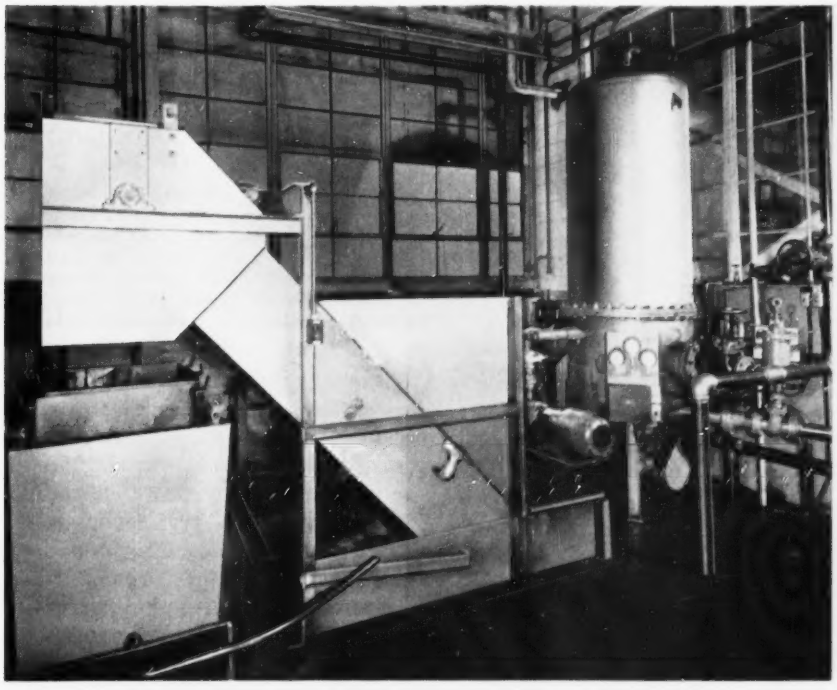


Fig. 4. General view of the equipment that comprises the coolant filtering system in the Bower factory

How Oldsmobile Cuts Off and Threads Rocket Motor Tubes

Lengths of tough molybdenum-steel seamless tubing are cut off and single-point threaded internally in rapid cycles on high-production machines equipped with carbide tools

By Reinhart F. Geitzel
Production Engineer, Oldsmobile Division
General Motors Corporation

ONE of the major items of ordnance being produced by the Oldsmobile Division of the General Motors Corporation at Lansing, Mich., is the shell assembly, or motor body, for 3.5-inch bazooka rockets. An important component of this assembly is a short tube requiring an internal thread at one end. Production is at a high rate, and exacting quality specifications are imposed on all operations.

Lengths are cut from S A E 4140 seamless tubing having an outside diameter of 2.042 inches and a wall thickness of 0.2 inch. This is tough steel, yet a cutting-off rate of six seconds per piece is maintained. A close-up view of one of the three Etna machines performing this operation is shown in Fig. 1. In this type of cutting-off machine, the work is held stationary. A revolving cutter-head enclosing the tubing supports a pair of 3/16- by 1 1/4-inch carbide-tipped blade type cutters. These cutters are diametrically opposite each other and feed in radially by hydraulic means. The cutters operate at a speed of 400 surface feet per minute. After each length is cut off, the tubing is automatically advanced.

As the next step, a 1 25/32-inch–16 buttress thread, 27/32 inch long, is cut in one end of the work. For this, a Lees-Bradner "Cri-Dan" single-point threading lathe, equipped with a circular carbide-tipped form cutter, is used. Close-up views of the front and rear of this machine are shown in Figs. 2 and 3, respectively. Eight

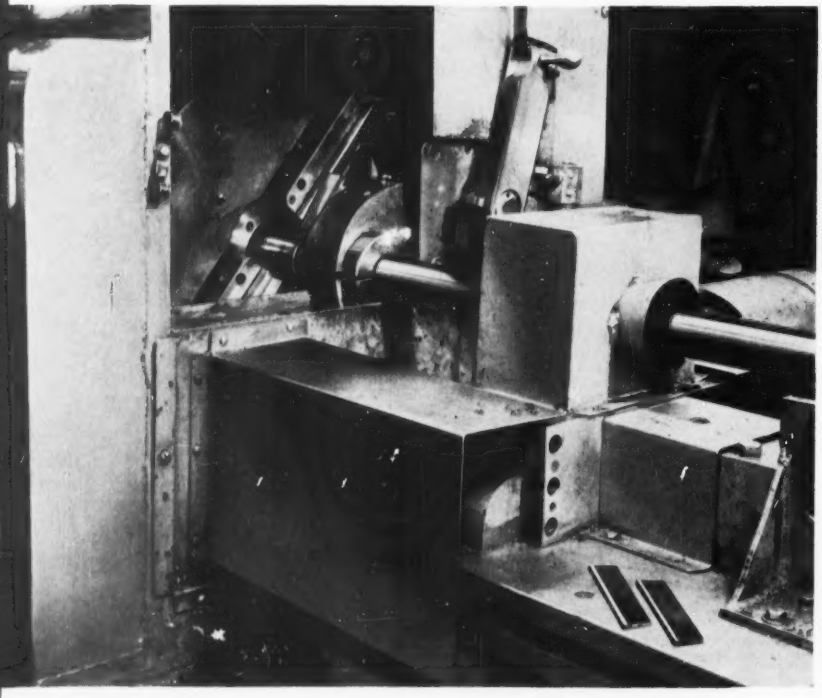


Fig. 1. In the foreground can be seen two of the blade type cutters employed on this machine. The cut-off through the 0.20-inch thick wall of the material is completed in a six-second cycle.

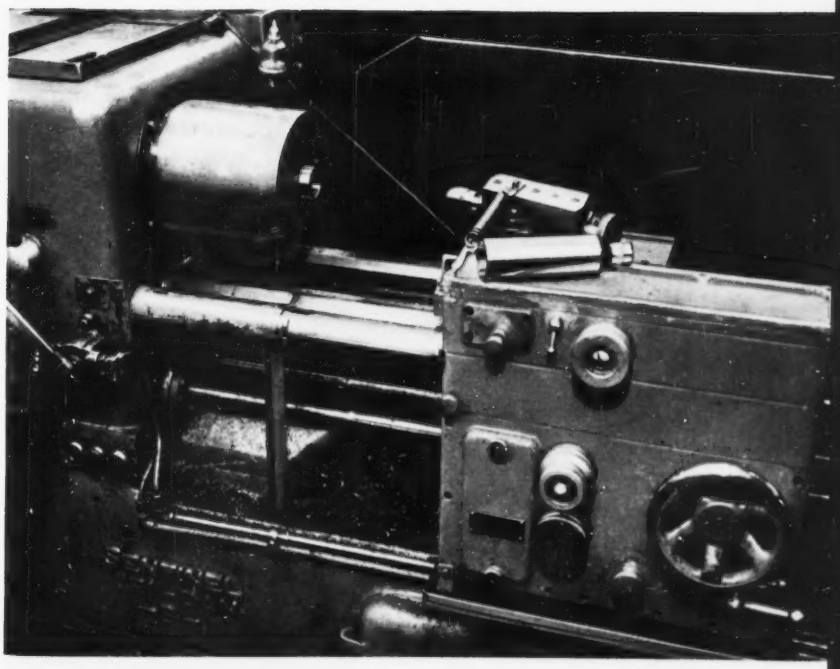


Fig. 2. The extremely fast and automatic shifting mechanism of this threading lathe produces quality threads on a high-production basis.

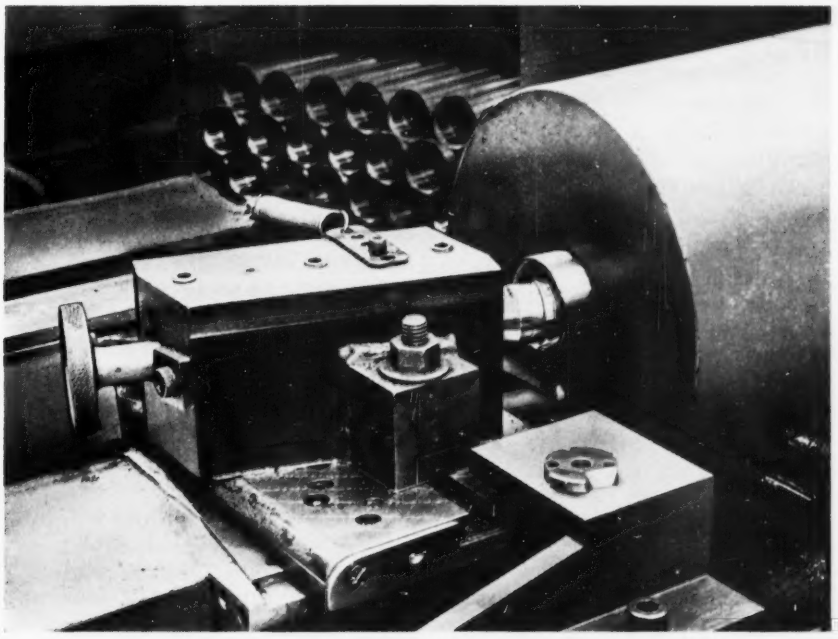


Fig. 3. For each threading pass, the cross-slide automatically adjusts itself to the proper thread depth and the cutter picks up its original tracking.

passes are required to complete the thread, but since they are performed automatically and very rapidly, the total time is only about 40 per cent of the time consumed were the thread tapped.

After the work is manually loaded in a diaphragm chuck, the lathe carriage is positioned pneumatically. To start the threading cut, the cross-slide adjusts itself to bring the cutter to a pre-set depth for the initial pass, and the carriage then moves longitudinally, at the appropriate lead, for the length of the threaded area. At the end of the pass, the cross-slide retracts to clear the thread, the carriage backs out rapidly until the cutter is again near its point of entry, and the cross-slide then adjusts itself to bring the cutter to a pre-set depth for the second pass.

All of these motions are entirely automatic and are repeated until the final pass has been completed, after which the carriage backs out an additional distance so that the work can be unloaded conveniently. Intervals between passes are much shorter than when single-pointing a

thread manually on a conventional engine lathe and, of course, the cutter always picks up its original tracking.

The drawing for the circular cutter is shown in Fig. 4. When positioned on the machine, the axis of the cutter is at an angle to the work so that the thread produced has the required buttress form. To double the life of the cutter before it must be removed for resharpening, two faces are ground at opposing points on its periphery. Each face is used individually, producing an average of 90 threads. A spare cutter can be seen on the bracket on the rear bedway of the machine, Fig. 3. A cutting speed of about 435 surface feet per minute is maintained for threading.

* * *

Vital Metal

It is estimated that almost half of the free world's production of nickel during 1953 was allocated for its military, atomic energy, and stockpile requirements.

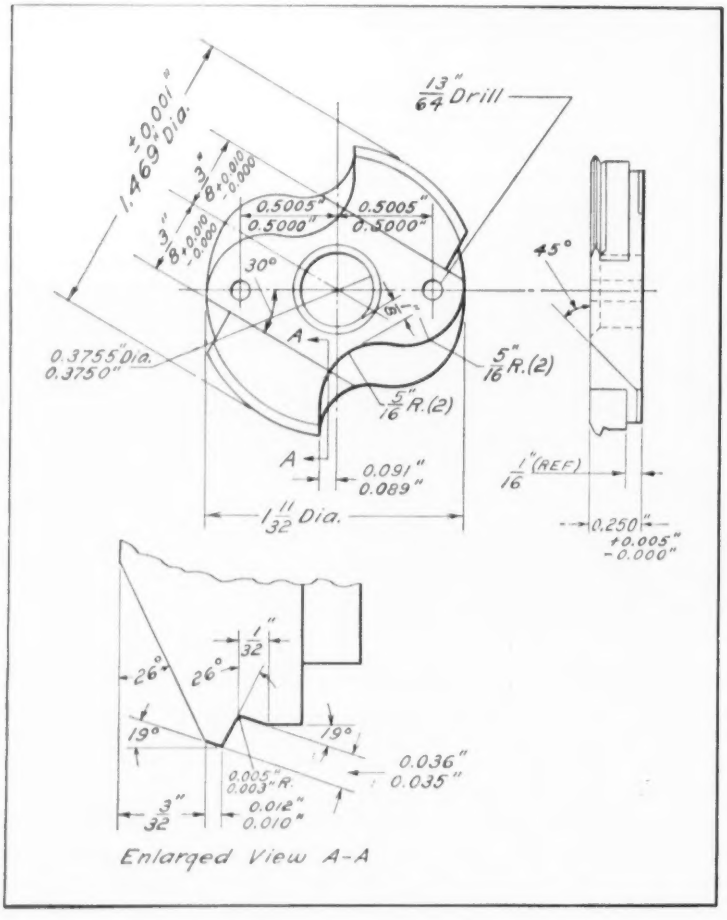


Fig. 4. Like other form tools, the circular cutter is readily resharpened on its radial face.

Large Aircraft Tail Structures Molded of Reinforced Plastics

Reinforced plastic fuselage structures are now being used for the United States Navy's new Neptune patrol bomber. Without sacrificing either strength or weight, the Zenith Plastics Co., Gardena, Calif., is producing five of these 17-foot stinger tails at about the same cost as one of conventional metal. This large molded piece is used to house the weapons for this long-range patrol bomber in seeking out submarines. The use of reinforced plastics for these aircraft structures also provides savings in manpower and factory floor space.

The new fuselage structure is molded of polyester resins developed by the Bakelite Co., a Division of Union Carbide and Carbon Corporation. These resins are used to reinforce Fiberglas cloth molded as a honeycomb sandwich in a simplified monocoque design. The stinger tail is produced with tools and equipment costing about 27 per cent of that required to produce the same metal airplane structure. Economical metal sprayed molds, with strong back-up shells of glass cloth impregnated with Bakelite polyester resins, are used to produce the five sections for each tail. Between 1/2 and 1 inch of metal is sprayed to form the mold, consisting of zinc, bronze, and aluminum layers.

The molding process itself is essentially simple. Several plies of glass cloth impregnated with Bakelite polyester resins are built up to form the outer skin and transferred to the mold. Precut glass cloth honeycomb treated with resin is laid on this outer skin, followed by another resin-impregnated laminate for the inner skin of the honeycomb sandwich. Atmospheric pressure is applied with a vacuum line to draw off excess resins and gases. The mold is then rolled into a curing oven and a few hours later is removed and cooled.

Two complete stinger tails are produced per day with one shift of thirty-five men in an area of 12,500 square feet. The assembled sections are about two-thirds the weight of metal stinger tails.

Fittings Die-Cast to Flexible Tubing

By Frank E. Beers, General Foreman
Die Casting Department, Tractor Works
International Harvester Co.,
Chicago, Ill.

MANY components for tractors are being economically die-cast at the Tractor Works of the International Harvester Co., Chicago, Ill. Among the most interesting of these are fittings cast directly onto the ends of short lengths of flexible tubing. This technique eliminates the necessity of separate operations in attaching the fittings. Moreover, since the metal is cast around the tubing under considerable pressure, tight joints are obtained.

Most of the tubing is helically wound and braided, as in Fig. 1. Fittings are also die-cast to copper-coated steel tubing, in which case the ends of the tubing are initially prepared with flanges. Practically any shape or size of fitting lends itself to the operation. As can be seen in Fig. 1, fittings may have threads or flanges, with bosses, cored holes, and wrench flats. The chief application of tubing with integrally die-cast fittings is for pressure grease lines in tractors. Fittings are made of zinc alloy.

The casting set-up on the small Madison-Kipp machine used is shown in Fig. 2. Tubing is supported above the die, with the end to receive the fitting projecting into the die cavity. To keep metal from entering the bore of the tubing, each length is slipped over an inexpensive core, consisting of a rod with a handle. A ferrule on the handle has a groove which is engaged by a forked locator positioned over the die. This locator is set vertically for the particular length of tubing used.

In each cycle, the tubing is manually placed over the core, and the core set in the locator. Then the die is closed and clamped, and the molten metal is injected to fill the die cavity. The casting, being small, freezes quickly, and the die is opened within a few seconds after the "shot."

Each casting is removed along with the core, which is then extracted from the tubing. Pressure exerted on the metal being injected forces it into the interstices of the tubing braid, and together with the shrinkage of the metal in cooling, insures a secure anchorage of the tubing in the fitting. About 100 to 110 castings per hour are produced.

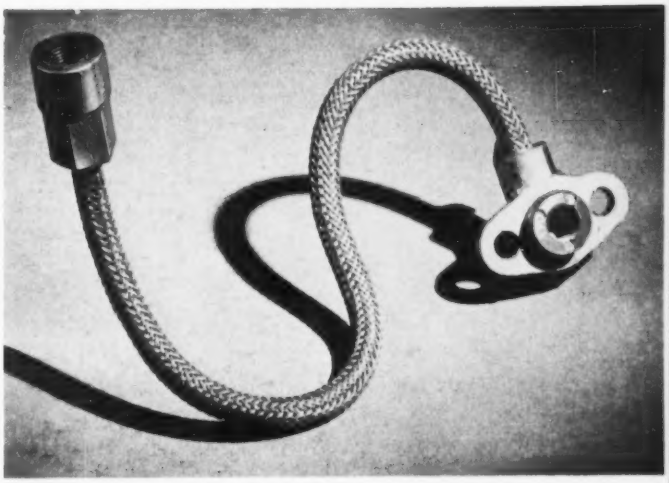


Fig. 1. Fittings are cast directly onto the ends of tubing, assuring tight joints and eliminating extra operations.

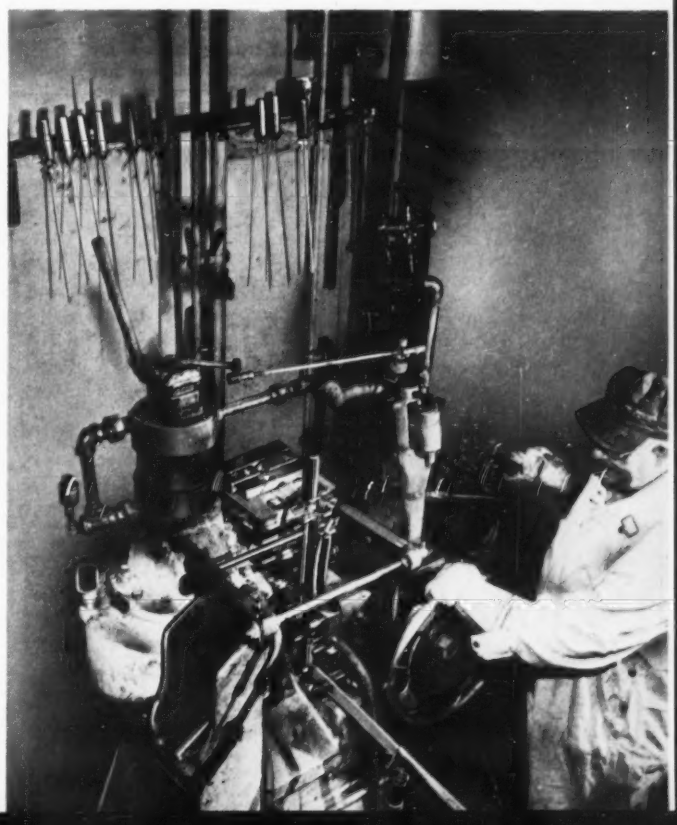


Fig. 2. During casting, the core prevents the molten metal from filling the bore of the tubing. Cores for different lengths and diameters of tubing appear in the background.

Assembled Electric Motors



Fig. 1. Assembled 1/4-H.P. oil-burner motors are masked to protect parts not to be painted, and then placed at 18-inch centers on overhead conveyor line.

WHEN the idea of painting completely assembled electric motors was first conceived, some people said it couldn't be done, while others thought it might be possible and was worth a try. After making extensive tests, the Ohio Electric Mfg. Co., Cleveland, Ohio, began painting six types of electric motors automatically with the Ransburg No. 2 electro-spray process. By developing different hangers and designing practical masking methods, it is planned to handle other types of motors later.

Formerly, the frame, cover, and terminal boxes of the motors were hand-sprayed. Now production has been speeded up by the use of the electro-spray process, and the need for cadmium-plating of some parts has been eliminated.

With the present set-up, an overhead conveyor line 290 feet in length operates at 2 feet per minute. The completely assembled motors are spaced on fixtures at 18-inch centers on the line. Just before the motors enter the paint area—where they are coated with black, wrinkle enamel—masking is applied, Fig. 1, to parts not to be painted.

The Ransburg unit consists of two 2-inch atomizing heads, one on either side of the line, as shown in Fig. 2. The motors are rotated as they pass through the electrostatic spray area. No compressed air is used in the equipment, the paint being electrostatically charged and atomized simultaneously.

Rapid rotation of each of the atomizing heads spreads the paint uniformly over the inner sur-

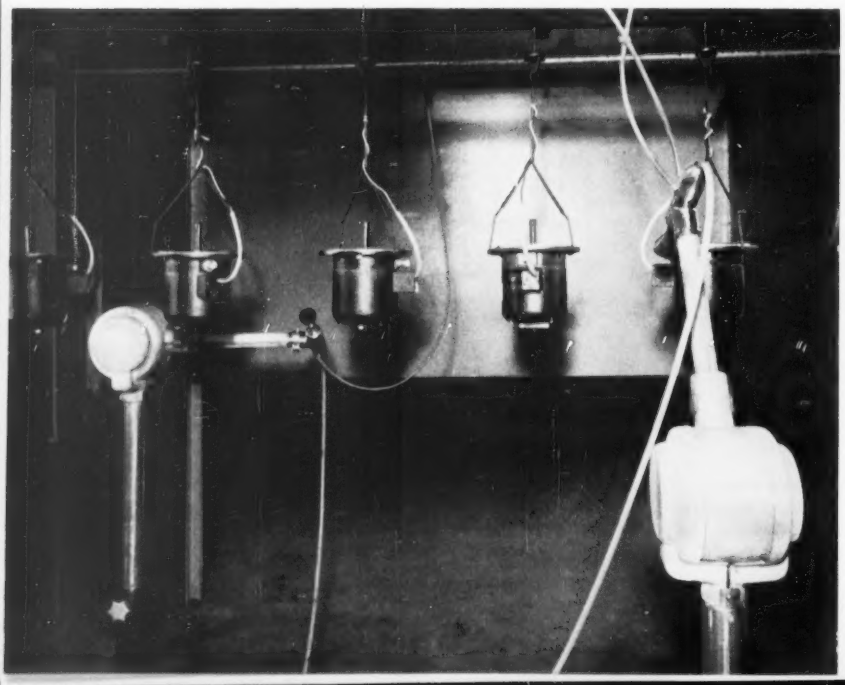


Fig. 2. Motors are rotated as they pass through spray area between two atomizing heads. Electrically charged paint particles are attracted to grounded motors.

Painted Automatically

By Tony Slavik
Plant Superintendent
Ohio Electric Mfg. Co.
Cleveland, Ohio

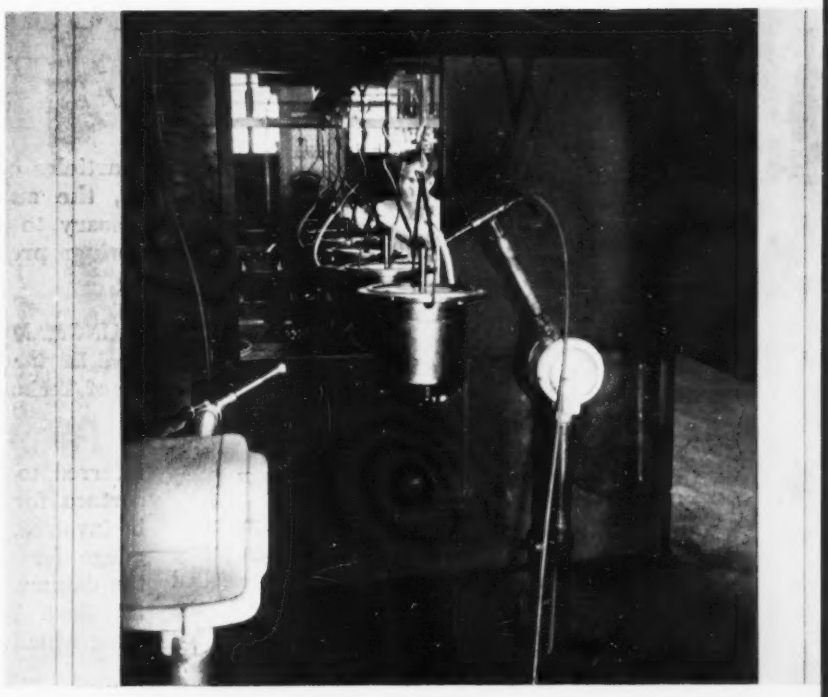


Fig. 3. As the painted motors leave the spray area, masking is removed and a weighted connection is attached for subsequent run-in of the motors.

faces, causing the paint to flow evenly to the outer edges. A source of electrostatic high potential, having one terminal connected to the atomizing heads, creates a strong electrostatic field between the heads and the motors that are grounded by the conveyor. Force of this field changes the paint into a spray of fine, charged particles, and creates an irresistible attraction that pulls the spray particles to the grounded motors.

As the painted units leave the paint area—and before entering an overhead infra-red oven—the masking is removed and a weighted connection is attached for the motor run-in, Fig. 3. After twenty-four minutes of baking at a temperature of 300 to 325 degrees F. (depending upon the motor size), in the overhead oven, Fig. 4, the motors are conveyed to the run-in area. Motors are removed from the overhead conveyor at the testing station.

Approximately 5 gallons of paint are used during an eight-hour shift to paint 100 units an hour. With the former hand-spray method, running of the paint was a problem. This has been eliminated by electrostatic spraying.

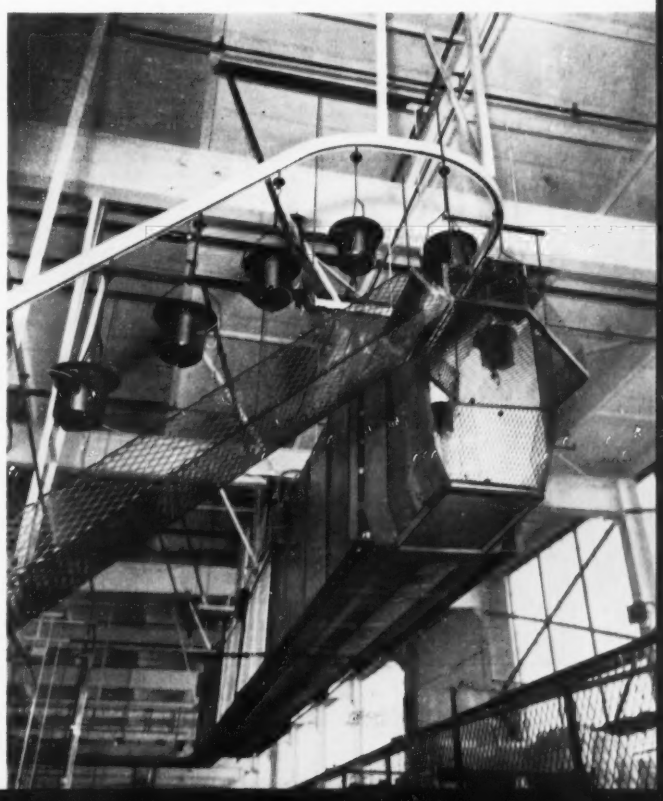


Fig. 4. Conveyor, 290 feet in length and traveling at rate of 2 feet per minute, carries painted motors through overhead infra-red oven for baking.

Dimensions and Tolerances for Mass Production

Summary—II

In this thirteenth of a series of articles on dimensions and tolerances for mass production, the author recapitulates the various steps that are necessary to make the dimensional information on detail drawings precise and complete

By EARLE BUCKINGHAM
Professor of Mechanical Engineering
Massachusetts Institute of Technology

Specifying Conditions of Position

The problems of position are much more complex than those of size since there are so many different conditions of position to be controlled and very little has been done about them in the past. Reliance has been placed on the accuracy and effectiveness of the jigs and fixtures; little or no reference to their requirements appeared on the detail drawing. Any definite procedure is new and, even in engineering, novelties of this sort are looked upon with suspicion.

In all cases, and however it may be done eventually, all dimensions of position must be referred to some definite datum, or reference surface, for each direction of position that may be involved. Hence, an effective practice or language for positional conditions must identify the datums from which these positions are established. These datums are always surfaces from which the positions are measured.

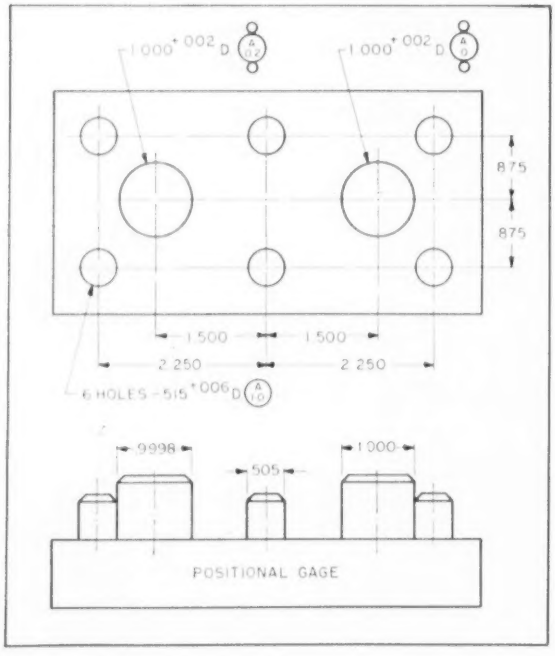


Fig. 18. Positional tolerance symbols applied to a manufactured part. These symbols consist of a circle within which a letter is used to specify the functional train to which the symbol belongs, and a figure specifying the variation in thousandths of an inch from the design position.

Positional Tolerance Symbols—Any position must be established from some base line or datum. Hence there must be some method of indicating this datum. Furthermore, a datum must be a definite surface.

In many cases, there is a group of positional features which are related to each other. Such positional features belong in some one functional train. Hence there must be some method of identifying each different functional train.

Positional tolerances may involve variations in a single direction, in two directions, or in three directions. Hence there must be definite datums for each direction of variation. A hole used as a datum will control positions in two directions. A flat surface will control positions in only one direction.

One positional tolerance symbol consists of a circle within which is a letter to identify the functional train to which it belongs and a figure beneath it which specifies the total variation or run-out in thousandths of an inch from the design position. The datum symbol consists of the same circle with two small circles, one above the larger circle and the other below it, with the

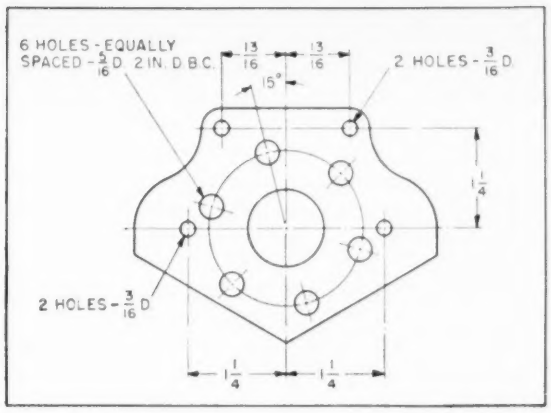


Fig. 19. Holes positioned on a bolt circle may be located by means of the size of the bolt circle and the angular position of the holes.

letter and figure for its positional variation. In the majority of cases, the positional tolerance on the datum is zero. These symbols are shown in Fig. 18, together with their translation into a positional gage.

Expressing Position in One Direction—The simplest condition of position, or a series of them from the same datum, is when there is only one direction, such as the positions of successive shoulders on a shaft or the axial positions of successive cranks on a crankshaft. Here, the expression of the dimensions of position on the detail drawing can be much the same as that for a dimension of size—namely, either the design distances are given with a tolerance or the limiting distances are given.

The delineation of a series of dimensions of position, all from a common datum, will take considerable space on the detail drawing if the common conventions of dimensioning are followed. The practice followed in the engineering department of one manufacturing plant is to indicate the common datum and then show only the start of the dimension line with a single arrowhead at the particular position. The datum symbol is given at the common locating surface and positional tolerance symbols are given with all of the dimensions of distance or position. In such a case, if the differences in position are large enough, all of these dimensions can be shown along one horizontal line. This practice conserves much space on the drawing; also the intent of the drawing is clear. There are many other opportunities to improve on conventional practice.

Sometimes, however, dimensions of position in a single direction may be more complex. For example, the pitch of a thread is a dimension of position. On lead-screws, in particular, not only is the distance between adjacent threads important, but also the distance between threads some distance apart. The permissible cumulative error, or tolerance, over several threads is much less than the sum of the permissible errors between adjacent threads. In such cases, two tolerances must be given, one for the permissible thread-to-thread variation and another for the permissible cumulative error over a specified number of threads, or distance. The inspection for such a condition generally involves direct measurement. There are many other conditions similar to this that must be met. One of these is the over-all height of an assembly of several sheet-metal components. When the dimensional conditions are critical, a system of selective assembly must be used.

Indicating More than One Datum—If more than one datum must be used for different dimensions of position in the same direction on the same component, then each datum is identified by a different letter in the positional symbol. Even in this case, only the start of the dimension line with a single arrowhead is needed. The letter in the positional tolerance symbol will identify the datum to which that dimension is referred.

Positional Dimensions of Holes—When positional variation is in more than one direction, such as in the positions of holes, the dimensions specifying the design positions are constructional dimensions and never carry a tolerance directly. The positional tolerance, however it may be expressed, gives the amount of variation from the established design position.

Holes positioned on a bolt circle may be located by means of the size of the bolt circle and their angular positions, as shown in Fig. 19, or

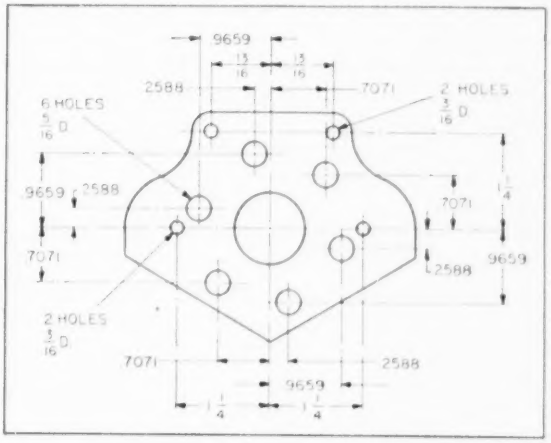


Fig. 20. Holes may also be positioned by specifying linear dimensions as shown, instead of as in Fig. 19.

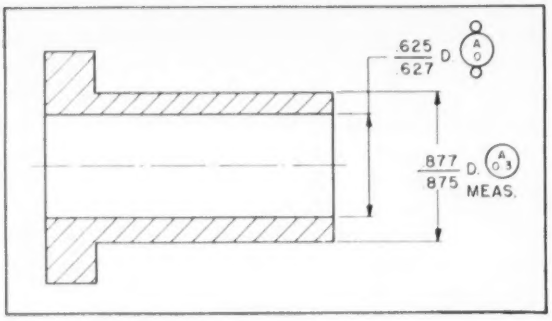


Fig. 21. Positional tolerance symbols may be used to specify limiting conditions of eccentricity or alignment. The bore of this bushing is the datum, and the position of the outside surface is measured from the bore.

by linear dimensions, as shown in Fig. 20. The choice depends upon the method to be used for making the drill jigs. If the positions are established on a jig borer with a circular dividing head, then the method shown in Fig. 19 gives the needed dimensional information directly. If the positions are established on a jig borer without a dividing head, then the method shown in Fig. 20 gives the needed dimensional information directly. The use of linear dimensions, as shown in Fig. 20, is preferable to the angular position method.

Effect of Positional Tolerances on Gage Holes and Plugs—Tolerances on dimensions of size are ignored in the design of a positional gage. In Fig. 18, the pins or studs are made smaller in diameter than the design sizes of the holes by the amount specified in the positional tolerance symbol. The large central hole at the right is the datum and its positional tolerance in this example is zero; hence the plug for this feature is made to the design size of this hole. When two datums are required and both of them are holes, a small positional tolerance will be required for one of these datums. In this case, the mating plug on the positional gage will be made smaller than its design size by an amount equal to the positional tolerance.

In the great majority of cases where the mating components are all made by the same organization, the drill jigs can be adjusted to each other and positional gages are not needed. When the mating parts are made by separated organizations, or a number of different plants are all producing the same product and the parts must be interchangeable, then positional gages become important.

Effect of Size Variations on Positional Errors—It can be pointed out that when the holes are made close to their minimum metal limits, the gage will permit greater positional errors than the amount specified by the positional tolerance. When the conditions involve alignment for assembly only, any greater variation under these conditions does not affect the assembly; if mating parts all meet the positional gage requirements, when assembled they will all permit the bolts to assemble through the holes without interference, and the tolerances and gages have served their purpose.

At times, the positional tolerance must be maintained within prescribed limits regardless of the sizes of the features. In such cases, the same positional tolerance symbols will be used with the addition of the letters *MEAS* directly below the tolerance symbol. Here the actual positional variation must be measured.

Alignment or Eccentricity Tolerances—The positional tolerance symbol can also be used to specify the limiting conditions of eccentricity or alignment. In Fig. 21, the datum is the bore of the bushing, and the position of the outside cylindrical surface is measured from the bore of the bushing. The notation *MEAS* under the positional tolerance symbol requires the checking of this surface with an indicator, and the total indicator reading is the amount of the positional tolerance.

Squareness Tolerances—The positional tolerance symbol can also be used to specify the squareness tolerance, as seen in Fig. 22. This variation is also measured with a dial indicator at a specified radius. The tolerance specified gives the total indicator reading.

Symmetry Tolerances—The specification of the allowable variation in symmetry has always been a troublesome problem. Symmetry is essentially a condition of position. The positional tolerance symbols apply here also. In Fig. 23 is shown a

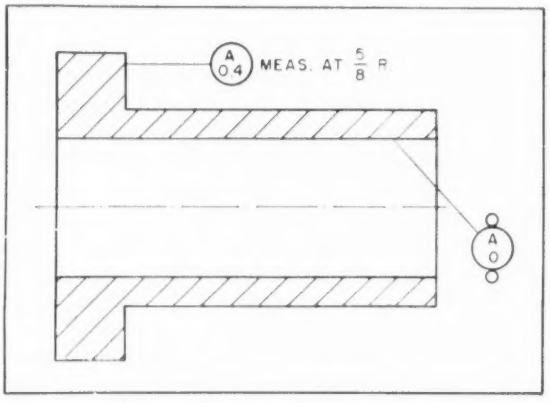


Fig. 22. Positional tolerance symbols may be used to specify squareness tolerances, as illustrated.

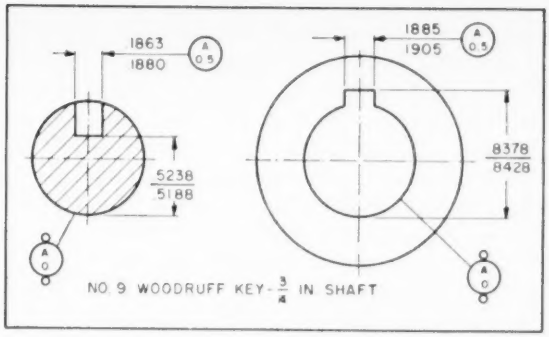


Fig. 23. Symmetry tolerances are conditions of position, and as such may be shown by employing positional tolerance symbols.

shaft and keyway together with the mating bore and keyway.

The positional gages for these features are seen in Fig. 24. Their design is essentially the same as the design of positional gages for holes. The tolerances on the dimensions of size of the individual features are ignored in the design of the positional gages. The outside surface of the shaft is the datum. A ring gage is made to the maximum metal limit size of the shaft with a symmetrical keyway, wider than the design size of the keyway in the shaft by an amount equal to the positional tolerance for this feature. A gage key is made to the design size of the keyway. This is inserted into the keyway in the shaft. Then the positional gage must pass over the assembly without forcing.

In similar manner, the bore of the mating part is its datum. A cylindrical plug gage is made to the design size of this feature. A symmetrical key is carried on this plug gage. The width of this key is made smaller by the amount of the positional tolerance for the keyway. This gage must pass through the bore without forcing.

Specifying Conditions of Function

Occasions may often arise where the required conditions cannot be expressed directly by dimensions and tolerances, yet they can be stated in terms of some definite test procedure or by the conditions that will be acceptable to a specific functional gage. Such, for example, is the case for an important spring which must exert a given force at one length and a given greater force at a second length. Here testing facilities must be provided to measure the force of the spring at the specified lengths. Such facilities are one form of a functional gage.

Other more complex conditions may be tested in a functional gage whose design and sizes may need to be determined by experiment and not be established directly from the dimensions and tolerances on the detail drawing. In such a case, the design of the functional gage and the conditions it will accept become an integral part of the detail drawing, either directly or by reference on the drawing. In the majority of cases, the need for these functional tests is not evident until after production has started. Then the need of further test becomes manifest, and these tests must be added to the dimensional specifications.

Acquiring the Technique of Production Design

Technique, in any art or science, can only be acquired by long practice and experience. At the same time, a definite effort must be made to analyze and to organize this experience to make it effective. One of the best ways to master any subject is to try to teach it to someone else. Hence the best way to present the subject of the development of technique in production design in general, and of the dimensioning of detail drawings with tolerances in particular, is to suggest methods of teaching the subject.

The following suggestions are therefore offered for those who wish to master this important subject themselves and for others who may be called upon to teach the fundamentals of this important phase of economical and effective mass production.

Selecting an Assembly for Study—Start with the selection of some small assembly. It must not have too many components or the amount of detail involved becomes too great. Six to twelve major components is enough at the start. An assembled unit must be used because only the basic elements of dimensioning can be considered with a single component. Needless to say, the elements of the subject must be studied and mas-

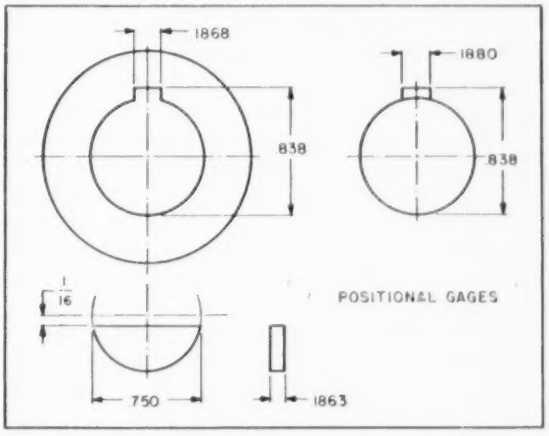


Fig. 24. Positional gages for the shaft and keyway and the mating bore and keyway shown in Fig. 23.

tered before their application to new problems can be considered.

If possible, visit some manufacturing plant and select some assembly or sub-assembly that is in production. Search out as much as possible of the early history of the production of the components of the selected assembly. Here a study of the changes made on the detail drawings in the course of production, their nature and the reasons for making them, will prove enlightening. Inquire and investigate what functional and manufacturing difficulties in the past have been overcome, and how. Ascertain all existing difficulties—functioning, assembling, and manufacturing. These are problems to be studied and to be solved if possible. Naturally, this involves the wholehearted cooperation of the manufacturer. If the student is actually working in the manufacturing plant, he will have the opportunity of doing this, mostly on his own time at first. If he demonstrates his ability of getting results, then he will make a definite place for himself in the organization.

Obtaining the Needed Information—Unless one has already established friendly and cordial relations with the management and engineering department of a manufacturing plant, this information is hard to get. No manufacturer desires to have any part of his product used as a "guinea pig," nor will any willingly admit—at the start at least—that he has ever had any difficulty with his product or with its manufacture. His organization has the "know-how." All the "bugs" are removed before the design leaves the engineering department. For them it is a simple, straightforward, and routine job.

Active service as a working member of a standards committee engaged in the formulation or revision of a dimensional engineering standard is one of the best approaches to this study of a component or product. Representatives of many different plants, all interested in the production or use of the item under consideration, are also members of this committee. The discussions there bring out all the problems, past and present, of design, manufacturing, inspection, and functioning that the several members have met. Here the picture is not as rosy and carefree as before. Difficulties are admitted, and efforts are made to find a solution. The exchange of experience among the several members helps to this end. In addition, personal acquaintance is made with the representatives of several manufacturing plants. Some of these contacts lead to lasting and valuable friendships, both personal and professional.

On the other hand, if one has already worked with a manufacturer or helped him to solve a problem of design, manufacture, inspection, or testing, the reception of a request for information of this sort is more sympathetic. Even when one is a stranger, patience, courtesy, and sincerity, coupled with a clear presentation of the purpose and use of the desired information, will generally obtain an affirmative answer to the request. The writer has had problems submitted to him by a manufacturer which were ideal examples for class use. These make the best problems because they are live and active ones. Something actually needs to be done about them. The writer has never yet failed to receive gracious, cordial, and even enthusiastic permission for their use.

Analyzing Functional Requirements—Once the assembly has been selected, the next step is to make a careful analysis of its operation and essential functional requirements. If functional difficulties have been reported, try to find some way of correcting them. If some additional service from the mechanism is demanded, study the possibilities of obtaining it. This is more in the nature of functional than production design, but the attempt to make improvements is an essential part of the production design. Once a product is actually being manufactured, its further development is a combination of the two types of design. This requires an intensive study of cause and effect. It is primarily a task for the instructor, but the students should be given a chance to assist. At least, they should be made aware of the problem.

Improving the Structural Design—The next step is to see what improvements and simplifications can be made in the structural design of the individual component parts to facilitate manufacture. This requires a background of knowledge of metal-working processes and their possibilities and limitations, a background which must generally be furnished by the instructor. Here again, the students should be given every chance for both suggestions and questions. Some may have had actual experience in a manufacturing plant. Every effort must be made to simplify all the elements of the problem and the design. Simplicity is the acid test of the development of the design of any product. To paraphrase the Count of Monte Cristo's maxim: All human inventions march from the complex to the simple, and simplicity is perfection.

Making the First Detail Drawing Draft—The next step is to make the first draft of the detail drawings. Every machined surface of each component must be studied in regard to its functional purpose, its relationship to any other fea-

tures, and the method and process that will be used to machine it. Functional and positional groups must be identified and marked. The design sizes of the several features are established first. Then tentative tolerances are assigned where necessary. If any values from a standard system of fits appear to be suitable, they are used. It must always be kept in mind that the extent of the specified tolerance may limit the choice of processes which are available to produce it. On the other hand, if it is evident that the results of a given process—drilling, for example—are adequate, then the tolerance assigned must be large enough for the use of that process. The dimensional specifications must be adequate to insure and control the exact functional conditions involved. If these dimensions alone are inadequate for this purpose, then suitable functional gages must be designed and made an integral part of the detail drawing, either by including them on the detail drawing or referring to them by note.

Translating the Dimensions into Gages—The next step is to translate the dimensional specifications on the detail drawing into inspection gages, and to check to insure that the components satisfying the prescribed inspection will be entirely adequate dimensionally. The translation of the dimensional specifications into inspection gages may be made by selection of the size and type of some gage of conventional design or by the design, in sketch or drawing, of a special gage for the purpose in question. Consideration must be given at this point to the conditions that these gages will or will not control. Conditions of size, form, position, and functioning must all be considered. Perfection is not the objective here. Adequate functioning of the components, coupled with ease or facility of manufacture, is the major objective.

Setting Up Tentative Operations List—The next step is to make a tentative operations list for each component. This involves the selection of the type of process and machine, and the best sequence of the successive operations. In actual practice, this selection is controlled to a large extent by the existing equipment in the plant. The same assembly, interchangeable in all respects, made in different plants with different types of manufacturing equipment, may be quite different in respect to the exact design of some of the features. For example, if a blind hole is finish-ground to size, it will have an under-cut at the bottom of the hole to provide a run-out for the grinding wheel. If, in another plant, this hole is reamed to size, a fillet will be present at the bottom of the hole. As another example, on an outside surface where the corners must be broken, in some cases a rounded fillet is the simplest to produce. In other cases with a different set-up, a beveled corner would be best. And so on.

In brief, the essential purpose in analyzing the features of the components of an assembly is to fit the components to their functional uses, and to fit them to the processes and machines that are to be used to manufacture them.

Designing Work-Holding Devices—The next step is either to plan or start the design of the special work-holding devices and special cutting tools that will be required for the several components in production. Even if these designs do not proceed beyond the making of preliminary sketches, chances are that several minor revisions, or changes, will need to be made on the detail drawings of the components.

The design of these jigs and fixtures can be used as a first stage in the subject of tool design. The designs of multiple-station fixtures and automatic turret type work-holding devices for continuous production are excellent subjects for use in tool design.

Conclusion

It is apparent that the seemingly simple task of detailing and dimensioning the component parts of an assembly which is to be made in quantity involves not only the techniques of drawing practice but also a knowledge of gage design and inspection, metal-working processes and machines, and cutting tools and tool design.

Needless to say, the greater the amount of experience of the engineer in all phases of this work, the more nearly complete the first draft of the detail drawing will be. However, in order to capitalize on the collective experience of any group, the policy must be established of keeping the detail drawings up to date and strictly in line with current manufacturing practices. Changes must be made on the detail drawings as soon as their need is apparent. The detail drawings of current production are used as models of those of the new product. Given a precise and definite language of drawings and dimensions with tolerances, what greater waste can persist in industry than the neglect of its use and the refusal to record the progress in the art of production?

This text is an attempt to outline a complete and logical procedure for the expression of dimensional information on detail drawings of the components of an assembled product. Improvements and added developments in expressing such information clearly, concisely, and without ambiguity should be continually sought.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

Tungsten Hard-Surfacing Applied with a Paint Brush

A "metal-cladding" that imparts to a surface a hardness and an abrasion resistance almost equal to metallic tungsten, and is self-lubricating as well, has been announced by the Lockrey Co., Southampton, N. Y., under the trade name of Tungstide. This material consists of metallic tungsten of near-colloidal particle size, suspended in a hard liquid plastic, into which is also incorporated a hardening form of molybdenum disulphide. The molybdenum disulphide provides dry, clean, built-in lubrication. The coating may be applied by brush, dip, or spray methods to any desired thickness.

Tungstide coatings are expected to find wide use in the plastic sports car body and aircraft field for sheet-metal forming molds and tools; for reducing wear on plastic drilling, assembly, and checking jigs; for replacing the metal inserts formerly used to cover wear spots on plastic molds and tools; and for reducing wear on vacuum-forming molds and plastic parts.

Cast Plastic that Replaces Safety Glass

A cast allyl base plastic with the transparency of glass, called Cocor CR-39, has been made available by the Cast Optics Corporation, Riverside, Conn. In one instance, this plastic was chosen to replace safety glass in the eye-guards of grinding machines since it exhibits a high impact strength and resistance to the abrasive effects of flying carborundum and metal particles.

"Free Machining" Properties Extended to More Die Steels

The Latrobe Steel Co., Latrobe, Pa., has announced that the "free-machining" properties of its Olympic FM air-hardening die steel have been extended to its entire line of high-carbon high-chromium die steels. This entire line can now be obtained as FM (free-machining) steels. The steels that are affected are Select B, an air-hardening A-2 type steel; GSN, an oil-hardening steel of the D-3 type; Cobalt Chrome, an air-hardening D-5 type; and BR-4, an air-hardening, patented abrasion-resistant die steel. The improvement in the machinability of these steels has no effect on their other physical properties nor do they require any change in the heat-treatment normal to regular types.

Pulley Lagging Method that Employs Cured Neoprene Sheet

A Neoprene sheet material, called Neolag, has been marketed by the Main Products Corporation, Dept. 562, 1241 Carpenter St., Philadelphia 47, Pa., for lagging pulley surfaces. The lagging, which can be performed in place without removing the pulley from its shaft, entails the use of a primer, a cold bonding agent, and Neolag. The lagging has increased the coefficient of friction of pulleys 24 to 330 per cent, it is claimed.

Thread-Grinding Oil Compound that Provides Adequate Lubrication

Vantrol 5299M, an inexpensive oil compound developed by the Van Straaten Chemical Co., 546 W. Washington Blvd., Chicago 6, Ill., is now being used in thread-grinding applications. This compound provides adequate lubrication in a process that requires heavy stock removal with a small area of wheel contact, the resulting pressure of which generates excessive heat. Its use reduces the rate of wheel wear, prevents uneven wheel wear, and permits a shallow cut to be taken when dressing the wheel.

Strippable Plastic Film Coat Eliminates Fire Hazard

The availability of Peel Filmite, a paint spray booth protective coating, has been announced by the DuBois Co., Inc., 1120 W. Front St., Cincinnati 3, Ohio. The use of this material in regular spraying equipment, and applied to the walls of a paint spray booth, provides a fireproof, peel-

able film. The film resists the action of alkalies, acids, oils, grease, fats, alcohol, gasoline, and heat. It dries to a uniform white, opaque coating in about ten minutes. When paint overspray accumulates, the operator can remove the paint-laden coating by peeling it off in big sheets.

Work-Hardening Chromium-Iron Alloy Exhibits Wear Resistance

A work-hardening chromium-iron alloy, called ZeVeScal, exhibiting a good wear life under extremely abrasive conditions, has been announced by the Calumet Steel Castings Corporation, 1636 Summer St., Hammond, Ind. The microstructure of the alloy consists of complex carbides of chromium, molybdenum, and iron in a matrix of austenite. It can be work-hardened to hardnesses in excess of 700 Brinell on the wear surfaces. The alloy has sufficient toughness to make it suitable for paddles, sand impellers, and conveyor rolls in gravel mixers and similar machines where wear resistance is a prime requisite.

Photographic Paper for Use in Diazo and Blueprint Processes

In order to promote faster print-back speeds when diazo or blueprint reproductions are to be made, the Eastman Kodak Co., Rochester 4, N. Y., has developed a highly translucent, durable contact paper called Kodagraph Contact Paper Translucent. The paper will withstand considerable handling and use and is processed in the same manner as all other Kodagraph Contact Papers. Use of this paper, on which photographed lines can be made to appear as dense black, clean, sharp, and legible lines offers an advantage in that the lines can easily be erased by a slight moistening followed by erasure with an ordinary pencil eraser. The paper is being offered in all standard Kodagraph Contact Paper sizes.

Silver-Plating Metals by an Economical Method

Two industrial silver-plating solutions, Nu-Silver Nos. 66 and 67, have been announced by Specialty Manufacturers & Distributors, 508 New York St., Aurora, Ill. These liquids are applied with a soft cloth or swab or by immersion. The manufacturer cites the following advantages concerning their use: no plating equipment is needed; application is quick; corrosion is prevented; and appearance is enhanced. They are said to be useful for silver-plating electrical connections, terminals, and joints, when increased conductivity is desired. The No. 66 formula is for plating non-ferrous metals, while the No. 67 is intended for plating both ferrous and non-ferrous metals.

Compound that Repairs, Fills, and Builds Up Metal

An aluminum compound has been developed that can be used for repairing castings, filling joints in sheet metal, and building up surfaces of patterns, molds, and dies. This epoxy resin compound, known as Metalset (A 101), is a product of the Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City, N. J. It hardens by polymerization following the addition of a curing agent, not through evaporation of a solvent—which means that it can be applied in any thickness without cracking and with negligible shrinkage. A spatula can be used to apply the compound.

Metalset adheres strongly to metal, particularly aluminum, and many other surfaces. It is hard, tough, and machinable down to a feather edge, and has good chemical stability. The compound can be stored indefinitely and is non-combustible. The accompanying series of illustrations shows its use in the repair of a circular disc later finished by a machining operation.



Metalset, an aluminum compound being used to repair a disc. On the left, disc prior to repairing; in the center, the compound (to which a curing agent has just been added and mixed) being poured into the space to be filled; and on the right, the repaired piece—the compound having hardened and the disc having been finish-machined

Soluble Oil Cutting Fluids

By Dr. R. K. Gould
Technical and Research Division
The Texas Company
New York City

ANYONE concerned with the machining of metals should be well aware of the importance of cutting fluids to the success of most operations. When properly selected, applied, and handled, they can be of tremendous benefit. On the other hand, it must be recognized that there are certain problems that cannot be solved simply by the application of a cutting fluid.

Cutting fluids can be considered as having two basic functions in the machining process: (1) to serve as a coolant and remove heat from the cutting tool, work-piece, and chips; and (2) to serve as a medium for reducing the friction that occurs as the chip slides up the face of the tool.

Mineral oils, either straight or containing additives (such as fats and sulphurized and chlorinated materials), are most effective in performing the second of these two functions. Because the reduction in friction is due mainly to chemical action, there must be sufficient time for the reaction to occur. As cutting speeds approach high values and the time of contact becomes less, it is increasingly difficult for a fluid to reduce the friction.

In order for a liquid to be most effective as a coolant, it should have a high specific heat, a high thermal conductivity, and a high heat of vaporization. Mineral oils are not among the best fluids in these respects, and consequently are not particularly effective in removing heat once it has formed. Actually, water is about the most efficient cooling medium known. However, there are numerous reasons why straight water cannot be employed as a cutting fluid. Probably the most obvious one, as well as the most important, is its rust promoting characteristics. Also, it has no value as a lubricant.

There is a way in which the additional properties desired can be imparted to water—through the use of soluble oils. These oils have been so compounded that they will form a stable emulsion when mixed with water. Since water is the major component of the emulsions as they are normally used, it still can function efficiently as the coolant. The mineral oil and the additives provide desirable lubricating, anti-friction, and anti-corrosion properties to the emulsion. Various combinations of cooling and lubricating properties can be imparted to emulsions by changing the ratio of the soluble oil to water.

What Are Soluble Oils?

Soluble oils are not really "soluble" inasmuch as they do not form a true solution when mixed with water. They form an emulsion and actually should be termed "emulsifiable oils."

The first requirement of a soluble oil is that it must emulsify readily with water and form a stable emulsion. Consequently, the basic ingredient in all such products is the emulsifier. There are many emulsifiers from which to choose, but it is impossible to rate their effectiveness categorically. The nature of the oil and also of the water to be used both influence their emulsifying ability. A soluble oil manufacturer will choose an emulsifier or combination of emulsifiers which best suits his oil and, in so far as possible, the type of water with which it will be used.

Some soluble oils may contain only the emulsifiers. These can be used successfully in limited applications. On the other hand, most soluble oils will contain one or more additives to impart certain desirable characteristics or combat a particular condition that may be encountered after the oil has been placed in service.

Properties of Soluble Oils

Next to having good emulsification properties, the rust protection characteristics of the emulsion are probably the most important. Rusting of machined parts is highly undesirable, since removal of rust is both expensive and time-consuming. All soluble oil emulsions will afford some protection against rust formation, if only by virtue of the oil present. Also, some of the emulsifiers used are rather good rust inhibitors in themselves.

Products offering only border-line protection against rust can be employed in operations where rich emulsions (high ratio of oil to water) can be used, or where the metals being machined are not particularly prone to rust. In many cases, however, the rust protection of these products

is quite inadequate. This is particularly true in the machining, especially grinding, of cast iron. For such operations, soluble oils are available that contain rust inhibitors.

In grinding operations, there is often a tendency for the wheels to load rapidly and for the machines to become unusually dirty. This is especially noticeable when using a fine grit wheel to remove a small amount of stock. The emulsion wets the portion of the machine with which it comes in contact and, as the water evaporates, an oily film is left behind. This film holds the fine bits of grinding dirt, along with any dust particles that may be in the atmosphere. The result is a very dirty and unsightly looking machine.

Such conditions can be improved by using soluble oils containing increased detergency properties. Most of the emulsifiers commonly used in soluble oils are of the surface active type and have good washing characteristics. Thus in some cases, improved detergency is imparted to the oil by using an additional quantity of the emulsifier.

The water used to prepare a soluble oil emulsion will have a pronounced effect on its stability. Actually, for best results distilled water or steam condensate should be employed. Since this is impractical, the emulsion must be made with the water available, which varies widely in characteristics from place to place. Hard water is detrimental to the emulsification properties of most soluble oils. The components contributing to the hardness, such as calcium and magnesium, can react with the emulsifier in the oil and form insoluble materials which will separate and form a scum on the surface of the emulsion.

Soluble oils are available which have been so compounded as to form stable emulsions with hard water, and they should be used when needed. It is generally accepted practice to use these hard-water soluble oils when the water hardness is over 300 parts per million.

Soluble oils are sterile as they are prepared and delivered to the customer. However, bacteria can be introduced in an emulsion either through the water used to prepare it or through contamination of the emulsion in service. If permitted to propagate unabated, bacteria can cause some very undesirable results. Usually a soluble oil will contain a certain amount of bactericide to afford the emulsion some measure of protection against bacterial growth.

There are increasing numbers of soluble oils obtainable today containing extreme-pressure characteristics. They are generally referred to as heavy-duty soluble oils, and emulsions prepared from them combine good cooling capacity with anti-friction properties. In fact, these products can do all but the most difficult jobs which formerly could be handled only by cutting oils.

Manufacture and Storage of Soluble Oils

Soluble oils are among the most complex products that a lubricants manufacturer is called on to prepare. The ingredients will include the mineral oil, emulsifiers, at least one or more additives, and small quantities of a coupling agent and water. The water is required to increase the solubility of the emulsifiers and some of the additives. The coupling agent serves as a mutual solvent and enables the finished soluble oil to be a clear, homogeneous fluid. It also assists the oil to emulsify.

The final formulation of a soluble oil is arrived at only after a vast amount of laboratory research. Probably no other petroleum product demands such a delicate balance of ingredients. The first requirement of a soluble oil is that it emulsify readily and form a stable emulsion.

If subjected to sub-freezing weather for an extended period, there is a distinct possibility that stratification or separation of the constituents may occur. Products that have separated usually can be reconstituted by agitation. However, it is definitely not advisable to expose soluble oils to conditions which invite separation.

Drums should be stored indoors at room temperature when possible. If outdoor storage is necessary and there has been danger of separation, drums should be rolled before the product is used. It is also advisable to draw a sample and check the emulsification of the oil before using it. One spoiled drum can cause trouble.

Soluble oils are frequently delivered in bulk by tank car. During cold weather the product may become so viscous that difficulty is experienced in pumping it from the tank car to the bulk storage facilities in the plant where it is to be used. On such occasions, it is not uncommon to employ steam to warm the soluble oil so that transfer of the product may be facilitated. If steam is used, great care should be taken to assure that no localized overheating of the product can occur. It is entirely possible that some of the water and solvent in the product can be driven off when high-pressure steam is employed. Actually, hot water is much preferred to steam in these instances.

Regardless of whether the soluble oil is stored in drums or in bulk, it is highly essential that it be covered at all times to avoid contamination. The presence of contaminating materials can greatly affect the emulsification and performance characteristics of the product. Cleanliness

is perhaps the most important factor in the handling and care of soluble oils from the time they enter a plant.

Preparation of the Emulsion

Important factors influencing the performance and life of an emulsion are the manner in which it is prepared and the nature of the water used. First, the equipment used should be clean. This includes not only the vessel in which the emulsion is to be made, but also any containers used to transfer the oil and water. The temperature of the oil at the time of mixing is more important than that of the water. It should be at room temperature. If the temperature is so low that the product is thick and viscous, difficulty may be experienced in emulsification.

Oil should be added to the water—never water to the oil. This is a common mistake. There should be at least six or seven times as much water in the mixing vessel prior to the addition of the oil as the total amount of oil to be used. Also, for best emulsification the oil should be added slowly with agitation.

The ease of emulsification will vary from oil to oil. Some will form an emulsion almost spontaneously, while others will require considerable agitation. The nature of the emulsifiers and the type and number of the additives have a pronounced effect on the ease with which a soluble oil will emulsify. An emulsion in which the oil is only partially emulsified will not give optimum performance and, on the other hand, will usually cause trouble.

Many of the difficulties encountered with soluble oil emulsions, such as rusting, odor, and separation, can be traced directly to the water used. Consequently, it is best for the user to be thoroughly familiar with the properties of the water.

If hard water is to be used, there are two courses that can be followed satisfactorily: (1) Use a soluble oil that has been prepared especially for hard-water application; or (2) soften the water. If the latter is chosen, consult the soluble oil supplier as to what to use and how much. Treatment of the water always should be done before the emulsion is prepared and should be carried out in a separate vessel from that used for preparation of the emulsion. This will prevent the scum formed in the softening process from contaminating the emulsion.

Cleaning Soluble Oil Systems

In order to obtain top performance and maximum life from an emulsion once it has been prepared properly, it is essential that (1) the system into which the emulsion is to be installed be absolutely clean; and (2) the emulsion and the equipment be maintained as clean as possible during use.

Although the soluble oils are sterile as delivered, emulsions prepared therefrom can support bacterial growth. If allowed to proceed unchecked, bacterial action can raise havoc with an emulsion. Bacteria can feed on the emulsifier and other ingredients of the oil and eventually break them down and destroy their effectiveness. The products of bacterial action frequently have objectionable odors. Also these same by-products are acidic in nature and are corrosive.

There are numerous and devious routes whereby bacteria can contaminate emulsions and systems containing emulsions. The water used, the metal parts, workers' hands, refuse cast into an emulsion, and even the air are some of the possible sources of bacteria.

In cleaning soluble oil systems and the machines involved, it is mandatory that every bit of surface with which the emulsion may come in contact be thoroughly cleaned. Suitable cleansing and disinfectant solutions can be used to reach inaccessible areas.

The following is suggested as a general procedure that might be employed in cleaning systems using soluble oil emulsions. This is merely an outline and the actual mechanics can be varied to fit the system involved.

1. Drain or pump all of the used emulsion from the system.
2. Disassemble as much of the system as possible and manually remove chips, sludge, and other contaminants from all accessible surfaces.
3. Reassemble equipment and circulate a suitable detergent solution throughout the system. The circulation time will depend on the condition of the system.
4. Drain the detergent solution and circulate the antiseptic or disinfecting solution. Be sure it reaches all surfaces with which the emulsion comes in contact. If time permits, allow this solution to remain in the system overnight or over a week end to enable it to penetrate.
5. Drain the disinfecting solution, flush with water, and recharge with fresh emulsion.

Service Life of Emulsions

The length of time an emulsion will continue to perform satisfactorily will depend largely on how much attention is given to controlling factors that adversely affect the emulsion. Leakage of machine tool lubricating oil is one of the most common sources of contamination, prevalent

particularly in old machine tools and difficult to eliminate. It will contribute to the condition of dirty machines and wheel loading and, if allowed to persist, will necessitate removal of the emulsion. If lubricating oil can contaminate the emulsion, it follows that the emulsion may also contaminate the lubricating oil. This is equally undesirable from the standpoint of machine operation.

Systems containing emulsions are not meant to serve as a refuse disposal, spittoon, or wash basin. These common practices among machine operators serve to introduce bacteria into the system. Of course, the parts being machined may in themselves be a source of contamination. They may contain a rustproofing compound or other materials, or they may be dirty or rusty.

The air can contribute to contamination of the emulsion, as stated. For example, if the machines are near a plating room, the atmosphere may contain acid fumes which would be absorbed by the emulsion. This would contribute to corrosion and emulsion instability.

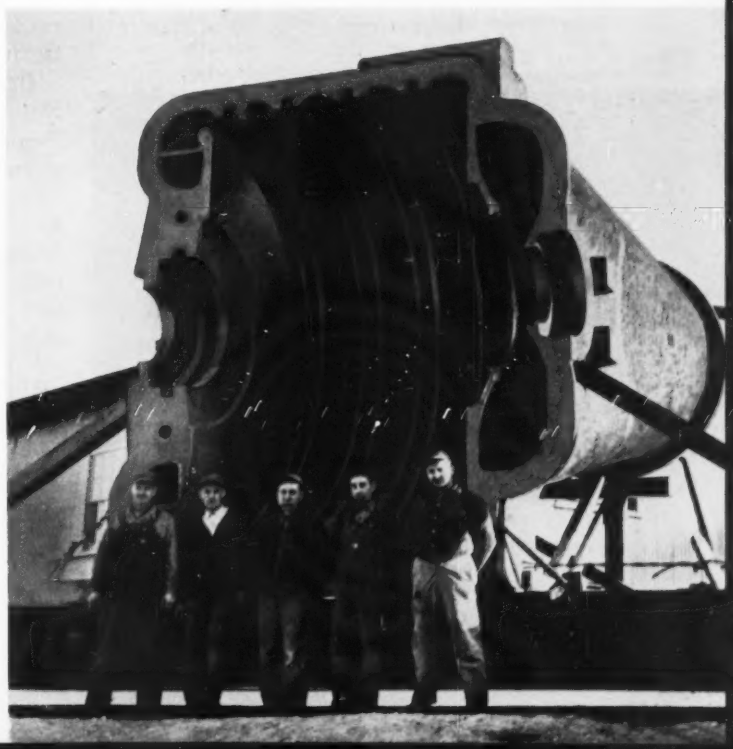
As water evaporates from an emulsion, the oil content will become increasingly greater. The end result of this trend, if permitted to continue unchecked, would be an inverted emulsion. It would transform from an oil-in-water system to a water-in-oil emulsion. However, unsatisfactory performance probably would occur long before this inversion.

The tendency of chips and grinding dirt to remove oil from the emulsion decreases the oil-to-water ratio. Cast iron, in particular, seems to possess an unusual ability in this regard. As the percentage of oil is reduced, the emulsion will decrease in many of its protective characteristics, particularly rust protection.

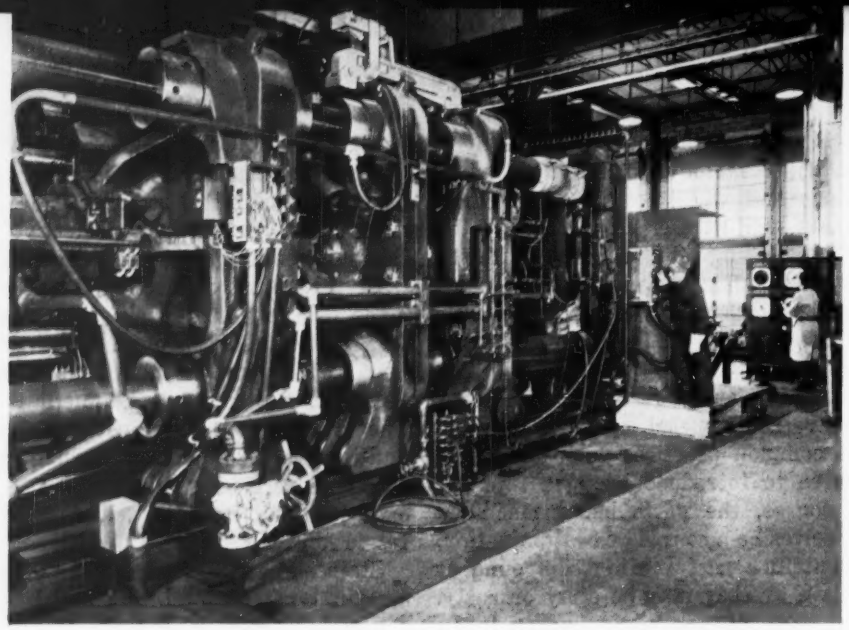
In this same connection, mention should be made of the bluish-black stain that frequently forms on freshly ground surfaces of ferrous metals. The stain itself is believed to consist of ferrous-ferric oxide, or magnetic oxide of iron. The freshly formed chips are highly reactive and can undergo oxidation, which results in ferrous and ferric ions in solution. A tan-colored emulsion may indicate a high concentration of ferric ions.

Staining can be delayed but not prevented by certain types of inhibitors and by maintaining a constant emulsion strength. Once started, however, it usually cannot be eliminated. This indicates that once the ferric ion reaches a critical concentration, staining will occur. Experience has shown that the use of a hard-water soluble oil with soft water will be more likely to give this black stain than if a soft-water type product were used.

Frequently the user will add various chemicals to a soluble oil emulsion to augment certain characteristics—such as rust protection, odor prevention, and detergency. The indiscriminate use of such materials can be injurious, and the oil supplier should be asked to suggest the material and the concentration that may safely be added to an emulsion of his soluble oil.



This large 70,000-pound blast furnace blower casting section was cast by the foundry division of Chambersburg Engineering Co., Chambersburg, Pa. Both cores and mold of this precision casting were made using the cement bonded sand method—a technique in which this company specializes. The blower, made up of this and another section, is capable of delivering 121,000 cubic feet of air per minute at a discharge pressure of 35 pounds per square inch gage. Its source of driving power is a large steam turbine.

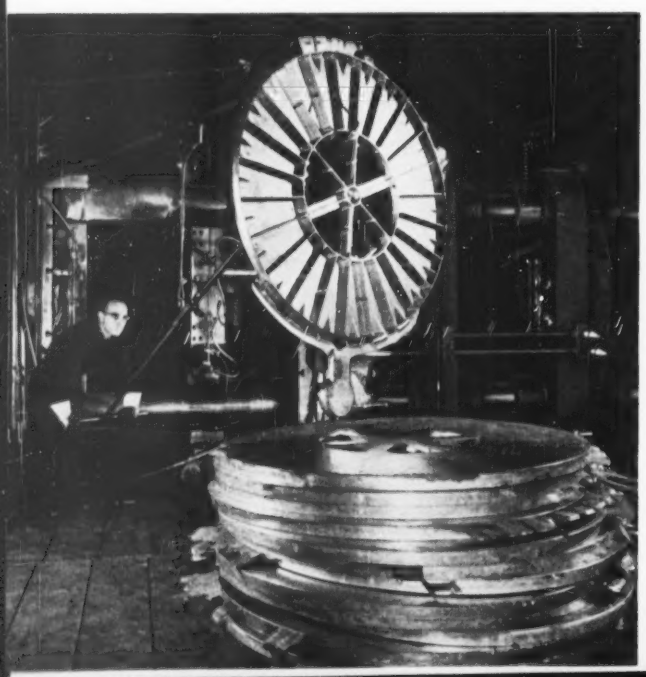


Giant Die-Casting Machine in Operation at Doehler-Jarvis

A DIE-CASTING machine claimed to be the largest ever built is now in operation at the Toledo, Ohio, plant of the Doehler-Jarvis Division, National Lead Co. The unit was conceived nearly five years ago as a means of providing the automotive industry with more and larger aluminum die-castings. Its construction, a joint undertaking of Doehler-Jarvis and the Kaiser Aluminum & Chemical Corporation, required more than two years.

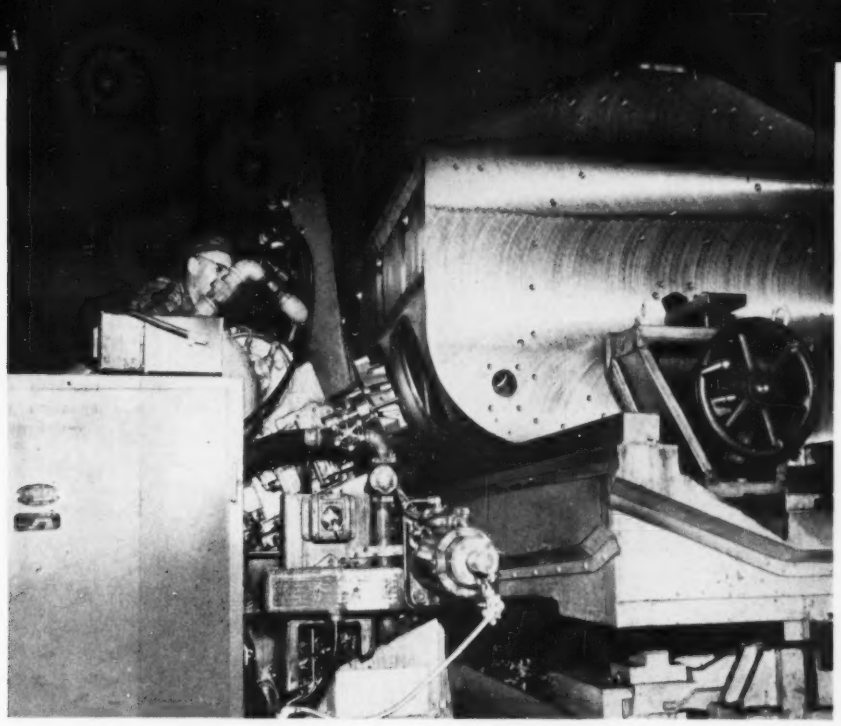
Aluminum die-castings up to 75 pounds and zinc die-castings up to 200 pounds can be produced. By previous die-casting standards, aluminum castings of 20 pounds and zinc castings of 45 pounds have been considered practically maximum. With a die-bar center distance of 72 inches, the 250-ton machine accommodates dies weighing as much as 50 tons. The largest machines operated by the company up till now had a die-bar center distance of 48 inches. They were used to turn out large transmission housings, radiator grilles, and other die-castings of similar proportions.

On a 75-pound aluminum casting job, the machine operates at a production rate of thirty "shots" per hour, and consumes in excess of 2250 pounds of metal per hour. To permit this high rate of metal consumption, it is equipped with two 12,000-pound reverberatories. Automatic features of the machine include cycle controls, controls for metal temperature for the furnace and the ladle, and recorders for water-cooled shot-sleeve temperature and die temperature.



(Above) This 72-inch die-casting machine in operation at Doehler-Jarvis can produce 75-pound aluminum castings. A special building had to be erected to house the unit.

(Left) This die-casting flange for a cable reel weighs 41 pounds. After the gate and the flash are removed, it will be reduced in weight to 31 pounds.



Diesel Engine "Windows" Have a New Look

A SIMPLE change in the shape of an opening, together with two new boring units, has effected a major manufacturing refinement at the Electro-Motive Division, General Motors Corporation, La Grange, Ill. This plant is a leading producer of Diesel locomotives.

The operation involves the machining of crankcase and oil-pan inspection windows of the locomotive engine. The windows were formerly rectangular, but were recently redesigned to a circular shape. Each of the engine cylinders is provided with windows in both the crankcase and oil-pan, which are mild-steel weldments. In service, aluminum covers are sealed over the windows to prevent the escape of oil fumes.

Initially, the window areas of the steel plate are punched out under size. After the structures are welded, a machining operation brings the openings to size and forms a flat border for the covers to close against. Now, with the windows round, a large inserted-blade type step-milling cutter bores the opening to size and counterbores the border in a single stroke. The new design cleared the way for the development of the boring units here illustrated.

The two machines were constructed by the Snyder Tool & Engineering Co. In principle, the cutter is mounted on a carriage that indexes along a rail to operate at each opening in sequence. When a row of holes is completed, an integral work turntable rotates 180 degrees and the opposite row of holes in the weldment is machined. Except for the angular position of the cutter-spindle in the crankcase unit, shown in the heading illustration, both units are alike.

The 12-inch window diameter and the 13-inch counterbore diameter are produced by the seven carbide blades of the step mill: two blades rough-bore, two semi-finish-bore, two finish-bore, and the last one counterbores. A two-speed Delco 20-H.P. induction motor on the carriage drives the spindle. Boring is performed at a surface speed of 300 feet per minute. For counterboring, the speed is halved by means of a micro switch.

The cutter feeds hydraulically at a rate of 3 inches per minute for boring, then drops to 1/2 inch per minute for counterboring. During boring, the feed is transmitted through direct hydraulic linkage. The slower counterboring feed, which is not satisfactorily obtainable by this means, is set up indirectly. At the moment the head slide completes the boring feed, it banks against the side of a wedge; then a separate hydraulic piston slowly retracts the wedge so that the slide can feed at a reduced rate.

The sheet in which the windows are cut is 5/16 inch thick, and it is necessary to maintain a minimum thickness at the counterbore of 3/16 inch. To compensate for any slight variations in the dimensions of the weldment, the thickness

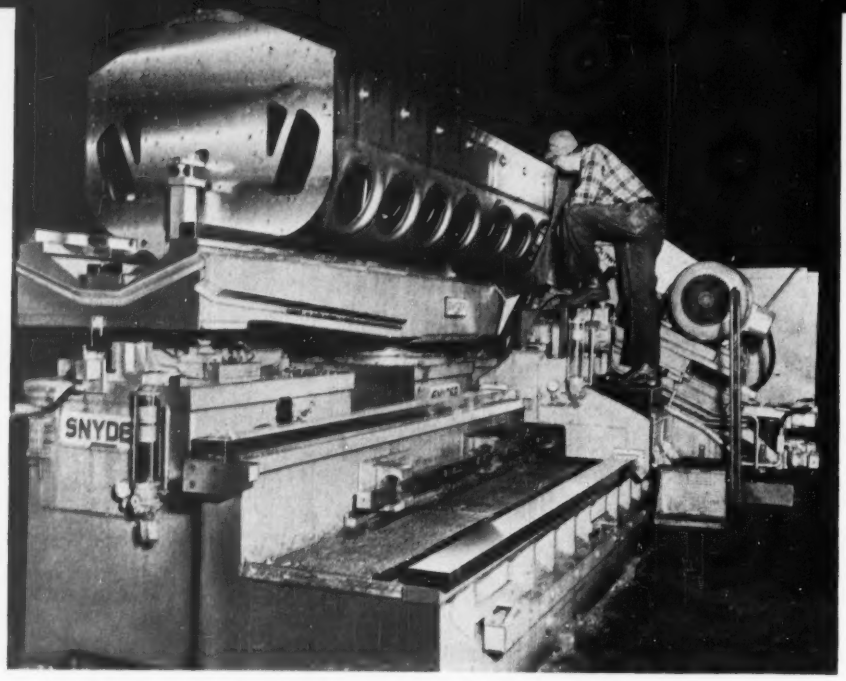


Fig. 1. The carriage is indexed along the rail to machine each of the inspection windows of the crankcase in sequence.

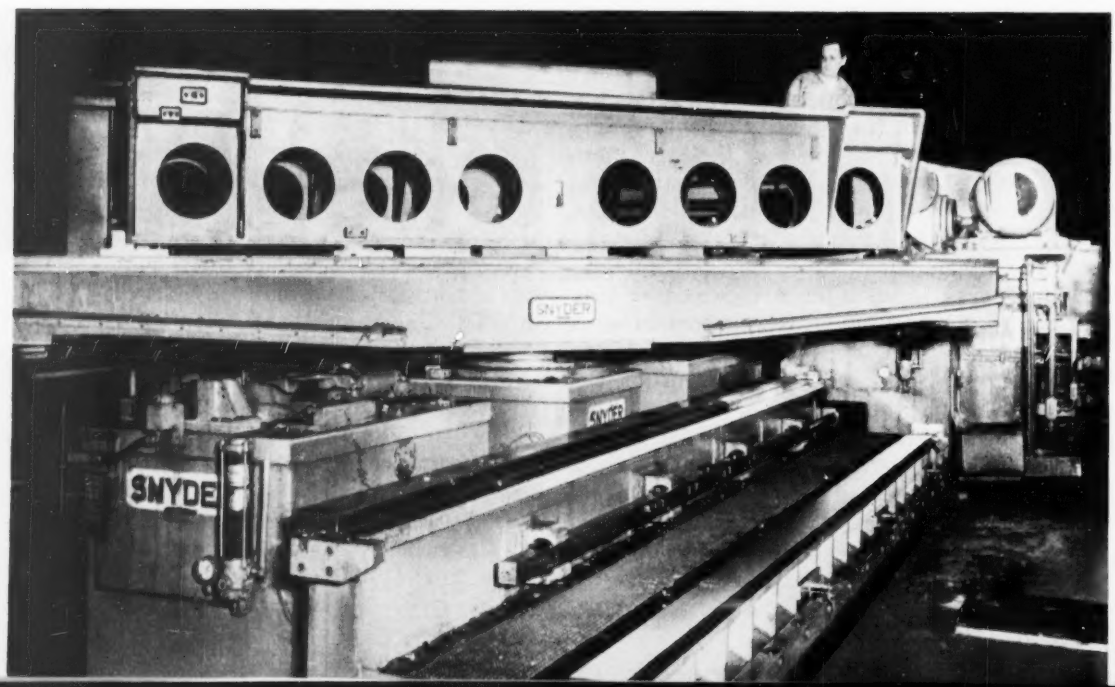
at the counterbore is controlled independently at each window. This is done during the approach stroke of the head slide by a finger that strikes the surface of the work. The length of the feed stroke is automatically determined from this point of contact.

Another view of the crankcase boring unit is shown in Fig. 1. All movements of the machine are directed from a push-button panel on the carriage. The carriage index and turntable rotation also are hydraulically actuated.

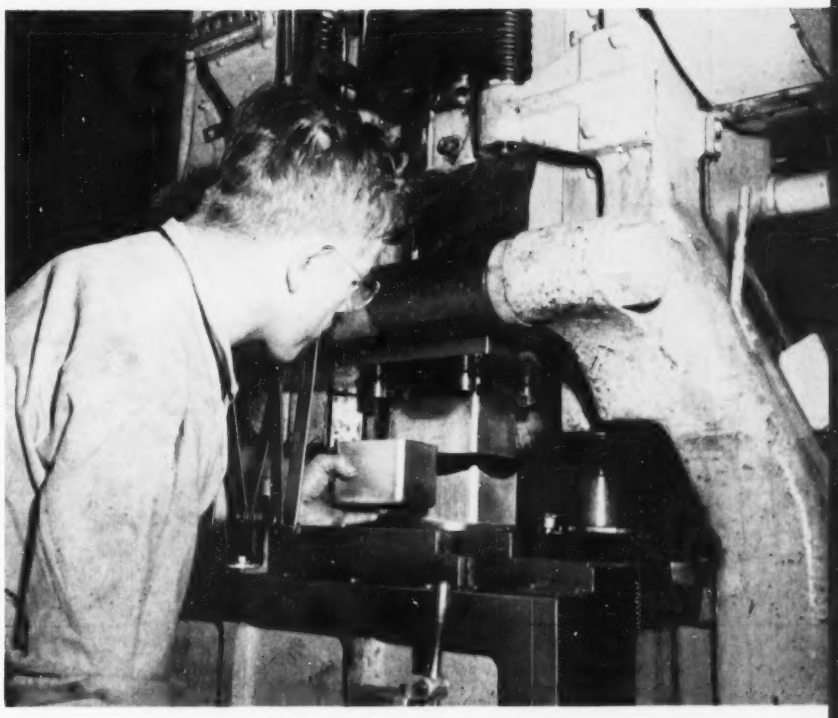
A master bar located along the bed controls the position of the carriage during the index from window to window. Dogs on the bar trip a limit switch which arrests the movement of the carriage. Should more precise location then be indicated, provision is made for the operator to move the carriage manually. Diesel engines in production at Electro-Motive have six, eight, twelve, or sixteen cylinders; the boring units are adaptable to all of them by interchanging the appropriate master bar.

In Fig. 2 is shown the oil-pan unit at a moment in the rotation of its turntable to bring the windows for the opposing bank of cylinders into machining position. A safety interlock requires the carriage to return to the far end of the bed before the turntable operates.

Fig. 2. With the windows on one side completed, the turntable is rotated to bring the opposite bank of the oil-pan into the machining position.



Experience Accumulates on Drawing Titanium



By Carter C. Higgins
President and General Manager
Worcester Pressed Steel Co.
Worcester, Mass.

OVER three years of research and experimentation on the drawing of titanium have been conducted by the Worcester Pressed Steel Co., Worcester, Mass. The high price and short supply of the metal make perfection of press forming techniques highly significant. The reason for this, of course, is that material is more efficiently used, producing less scrap, when it is stamped or drawn rather than forged and machined.

One conclusion reached is that in the main, commercially pure titanium can be drawn at room temperature. The various parts shown in Fig. 1, ranging in thickness from 0.025 to 0.078 inch, are of a commercially pure grade of the metal. Except for some "stretching" required of the rectangular plate, all were satisfactorily drawn at room temperature. On the other hand, elevated temperatures are indicated as being necessary for drawing any of the high-strength titanium alloys.

Most of the experimental parts have been drawn with tool steel punches and dies that were originally designed for other materials.



Fig. 1. These commercially pure titanium parts were drawn at room temperature with dies originally designed for other materials.

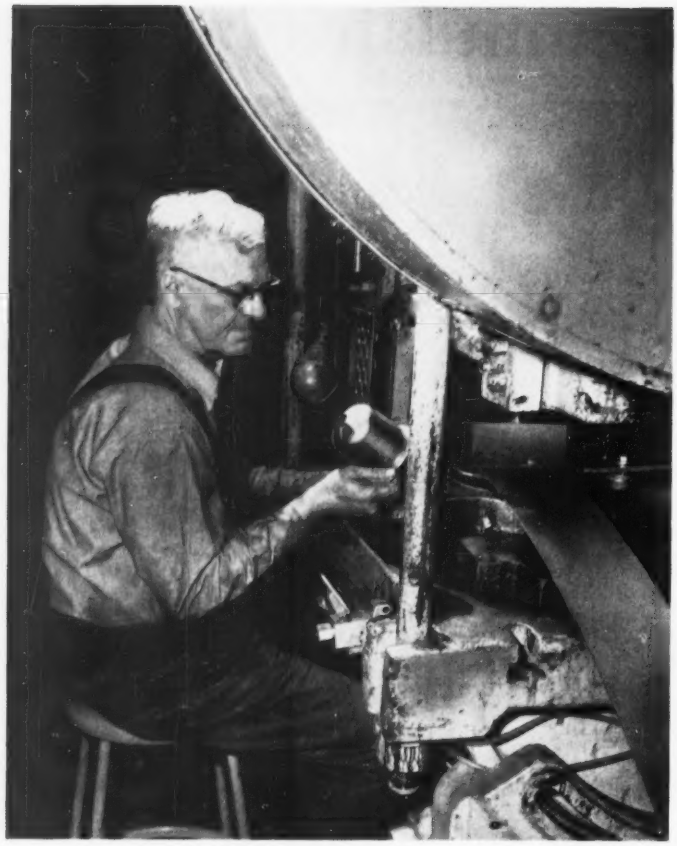


Fig. 2. Conventional equipment, such as this Toledo open-back inclinable press, is employed for drawing titanium, but speeds are lower and pressures higher than for carbon steel.

Fig. 3. (Below) Omitting the final stress-relieving anneal caused a corner of this cup to split open.

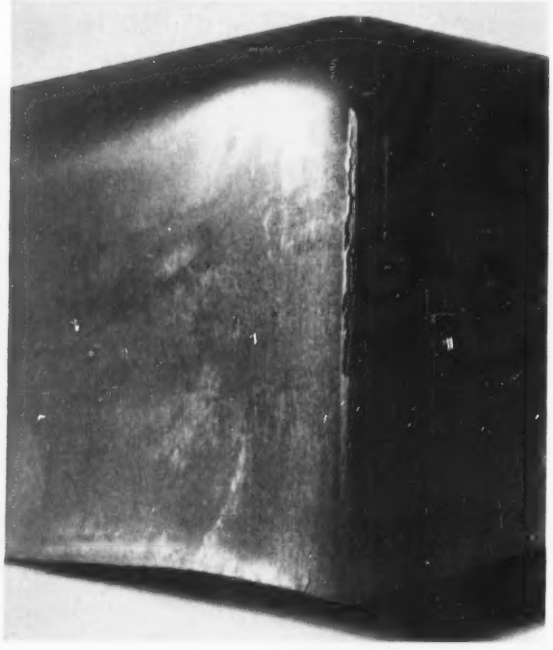




Fig. 4. (Above) One of the first titanium cups drawn. The bad scoring of the side wall was corrected when a proper lubricant was applied.

Fig. 5. This titanium shield for a Curtiss-Wright engine is less than two-thirds the weight of its stainless-steel counterpart.



Although they perform well, it is conceded that punches and dies specifically designed for titanium should have larger radii than those used for carbon steel. Also, press speeds are half of those for carbon steel, and pressures somewhat greater. A hardness value of 89 or 90 Rockwell B scale has been found ideal, though difficult to obtain.

Initial reductions of the commercially pure grades have averaged 40 to 45 per cent. Because of rapid work hardening, a stress-relieving anneal prior to each subsequent draw is essential. The shell held by the press operator in Fig. 2, as a case in point, had to be annealed between all five draws. Stress-relieving after the final draw is also important in reducing the tendency of the metal to season-crack. How a cup which was not annealed after the final draw was ruined by aging is shown in Fig. 3.

The high pressures required in deep-drawing titanium have accentuated the importance of properly lubricating the work and the dies. Without adequate lubrication, the dies pick up small particles of the titanium and become badly roughened, and severe score marks and scratches appear on the side walls of the work. In Fig. 4 can be seen the poor surface finish of one of the first cups drawn, when unsuitable lubricants had been applied. Anodizing, bonderizing, or copper-plating the titanium sheet has aided substantially in making the lubricant cling to the surface. Carbide dies, it is anticipated, will further reduce the likelihood of galling.

A major drawback, according to the company, is the lack of uniformity of the available metal. Physical properties of titanium alloys are not controlled within a narrow band, and suppliers have not yet standardized them.

Currently, research is continuing under arrangement with the Boston Ordnance District. An experimental sub-press is being constructed. Tests will be conducted on drawing commercially pure titanium and titanium alloys. Sheets of various thicknesses—0.025, 0.050, 0.125, and 0.250 inch—will be drawn at press speeds of 20 to 25, 35 to 40, 55 to 60, and 75 to 80 inches per minute. The work will be drawn at room temperature, and also at 400, 600, 800, 1000, and 1200 degrees F. Other government-sponsored projects simultaneously under way aim to improve the practice of forging and machining titanium, to develop new processes of converting the ore to metal, and to increase the tonnage capacity of the mills.

With its favorable strength-weight ratio, corrosion resistance, and high-temperature properties, titanium offers the design engineer an ideal material to fill the broad gap existing between steel and contemporary non-ferrous metals. The aircraft engine shield being fabricated of titanium, Fig. 5, weighs but 1 pound 14 ounces, yet has the corrosion resistance and high-temperature properties of its stainless-steel counterpart, which weighs 3 pounds.

* * *

Film on Stampings Available

"Stampings for Electronics," a twenty-minute color and sound motion picture, describes the activities in the new plant of John Volkert Metal Stampings, Inc., Queens Village, N. Y. This concern is manufacturing electron-gun stampings used in picture tubes for the television industry. Depicting how accurate, progressive dies are designed, made, and put to work in automatic production equipment, the 16-millimeter film also demonstrates how lowered stamping costs help to bring television and other electronic miracles within the buying power of the American public. It is available from the company for free showings to technical societies and other groups.

Carbide Tooling Boosts Production on Automatics

Problems encountered in successfully applying carbide tools to multiple-spindle automatic bar machines are being solved. Here are a few examples of parts being turned out at greatly increased production rates.

A PROGRAM to develop the best methods of applying cemented-carbide tools to multiple-spindle automatic bar machines was undertaken jointly several months ago by the Cone Automatic Machine Co., Inc., Windsor, Vt., and the Carboloy Department of General Electric Co., Detroit, Mich. While many problems remain to be solved by the continuing program, sufficient progress has already been made to permit greatly increased production rates on several tough jobs.

Multiple-spindle automatic bar machines are one of the few groups of machine tools that have not been taking full advantage of the higher cutting speeds, longer tool life, and smoother surface finishes possible with carbide tools. Reasons for this are varied—the complexity of the machines, the need for experimentation, shortage of skilled operators, lack of tooling knowledge, the longer "down" time required for repairs or tool changes, and certain machine deficiencies which necessitate modifications.

For some time there has been discussion concerning the relative merits of the use of carbide tooling on multiple-spindle bar automatics, but there has been little information available about successful applications. So far, engineers taking part in the joint development program have found that (1) multiple tool set-ups on automatics are not barriers to cemented carbides; (2) tool-holders and auxiliary attachments should be engineered to meet job conditions; (3) proper selection of carbide grades and correct tool geometry are most important; (4) adequate horsepower delivered to the work-spindles is essential; and (5) a generous supply of water-based coolant to the cutting area is necessary.

Rigidity and design of the Conomatic multiple-spindle bar machines made them ideally suited for the use of carbide tooling. Only one design change was necessary—the sealing of bearings and shafts against water-soluble coolants. Also, increased horsepower could be applied and distributed to the spindle without modifying the machine.

Engineers planning the carbide tool development program agreed that conditions such as those encountered in the field would be simulated wherever possible. Actual jobs to be produced were selected on the basis that they required the use of commonly known tools, and were representative of volume production items on these machines. Typical of the parts produced thus far in the program are those seen in Fig. 1. Two leveling screws are shown at the left, a ball-bearing inner race at the center, and an oil cock at the right.

Threading at 417 Feet Per Minute

The leveling screws, actually used on Conomatic machines, are made from 1-inch diameter, S A E B1112 steel bar stock. Each screw, 7 7/8 inches long, has a 1-inch 14 N.F. thread extending over approximately 6 3/4 inches of its length. The screws are produced, two at a time, in the amazing time of only 3 5/8 seconds each, on a 1 5/8-inch, six-spindle Conomatic, Fig. 2, equipped with a 50-H.P. motor. In addition to the high production obtained, unusual features of this set-up are the feeding-out and threading of such a long part—especially the feeding and threading of two parts simultaneously.

Stock is fed out simultaneously against stops at the third and sixth positions of the automatic bar machine. After indexing to the fourth and first positions, the parts are chamfered and spot-drilled while supported by three rolls. Threading attachments are provided at the second and fifth positions. Automatic opening, revolving die-heads are employed—a Geometric Style KD at one position and a Jones & Lamson Model 22-23 at the other. Each head is equipped with four carbide-tipped chasers. At the third and sixth stations, the leveling screws are cut off from the bars and, with the same tools, the ends of the bars are rounded to the radius required at one end of the screw.

In this operation, the work-spindles are rotated at 958 R.P.M., providing a cutting speed of



Fig. 1. Typical parts produced on multiple-spindle automatic bar machines provided with carbide tooling: (left) leveling screws, (center) bearing inner race, and (right) oil cock

253 surface feet per minute for chamfering, cutting off, and forming. However, the die-heads are rotated at 628 R.P.M., giving a total effective speed of 1586 R.P.M., or 417 surface feet per minute for threading. The main tool-slide is fed at the rate of 0.0023 inch per revolution, while the cross-slides are fed 0.0026 inch per revolution for chamfering and 0.005 inch per revolution for cutting off and forming.

Cycle time (controlled by the cutting-off operation) is only 7 1/4 seconds, or 3 5/8 seconds per screw, and 994 screws are obtained per hour. Previously, the cycle time was 51 seconds and only 140 pieces were produced per hour. Also, only half as many cutting tools are now required.

Chamfering tools, combination forming and cutting-off tools, and chasers for this operation are all tipped with the new Carboloy Grade 370 cemented carbide. Both chamfering and cutting-off tools can produce about 700 parts before the tools require grinding, and the threading chasers have a life of approximately 1000 workpieces between sharpenings. Houghton Antisep All-Purpose Base cutting fluid, mixed with water in the ratio of 20 to 1, is employed for this tooling set-up.

Bearing Races Machined at 313 Feet per Minute

Inner races for ball bearings are being produced from S A E 52100 steel tubing at the rate of only 10 3/10 seconds per part on the Cone 2 5/8-inch, six-spindle, automatic bar machine seen in Fig. 3. This machine is also powered by a 50-H.P. motor, and all tools are tipped with Carboloy Grade 370 cemented carbide. Pre-



Fig. 2. Two leveling screws are produced every 7 1/4 seconds on this six-spindle automatic. Threading of the long screws is performed at 417 feet per minute.

viously, only 102 races were produced per hour, compared with the present rate of 349 per hour. Also, only seven carbide-tipped cutting tools are now required, and fourteen tools were formerly used.

As shown in the tooling lay-out, Fig. 4, the inner race is successively machined by a breakdown blade and butt facing tool of the flat-form type at the first position; a chamfering tool and internal recessing attachment at the second position; an external forming tool at the third position; a reamer mounted on an auxiliary, accelerated-feed spindle at the fourth position; and a cut-off blade at the sixth position. The fifth tooling position has been left open for later application of a bearing race marking attachment on the main tool-slide.

The work-spindles are rotated at 519 R.P.M., providing a cutting speed of 313 feet per minute. A feed rate of 0.003 inch per revolution is used for the breakdown, chamfering, forming, and cut-off tools mounted on the cross-slides. The main tool-slide, on which the facing tool and recessing attachments are mounted, is fed 0.010 inch per revolution. The recessing tool itself is fed toward the bore of the work-piece at the rate of 0.0026 inch per revolution. An accelerated feed of 0.012 inch per revolution is employed for the auxiliary spindle on which the reamer is mounted.

The same cutting fluid, also mixed with water in the same ratio, is used for this set-up. Tool life for the different operations varies approximately as follows: 724 ball-bearing inner races per grind for the internal recessing tool, 1270 for facing, 1518 for the breakdown tool, 1890 for chamfering, 810 for forming, 720 for cut-off, and 1270 for reaming.

Carbide Tooling Eliminates Grinding Operation

Oil cocks are produced on a third 50-H.P. Conomatic by means of the set-up seen in Figs. 5 and 6. With the carbide tools and higher speeds used, production time per part is only 8 seconds. Previously, 45 seconds were required to produce each part. Also, two subsequent operations—centering of the back end and grinding of the taper—were completely eliminated by means of the new set-up. The cocks are made from 1-inch hexagonal bar stock of S A E 1112 steel on a 1 1/2-inch, six-spindle automatic.

At the first position, the part is formed, spot-drilled, and turned by means of a special two-tool roll turner. The taper is formed at the second position, while a groove is cut and the outer end faced and chamfered by a combination butt tool at the third position. Roller supports are provided at both of these stations to increase the rigidity of the work-piece during machining. The tapered surface is shaved at the fourth position, rough-forming and threading are performed at the fifth position, and the part is cut off at the sixth station.

Carboloy Grade 78B carbide is used for the

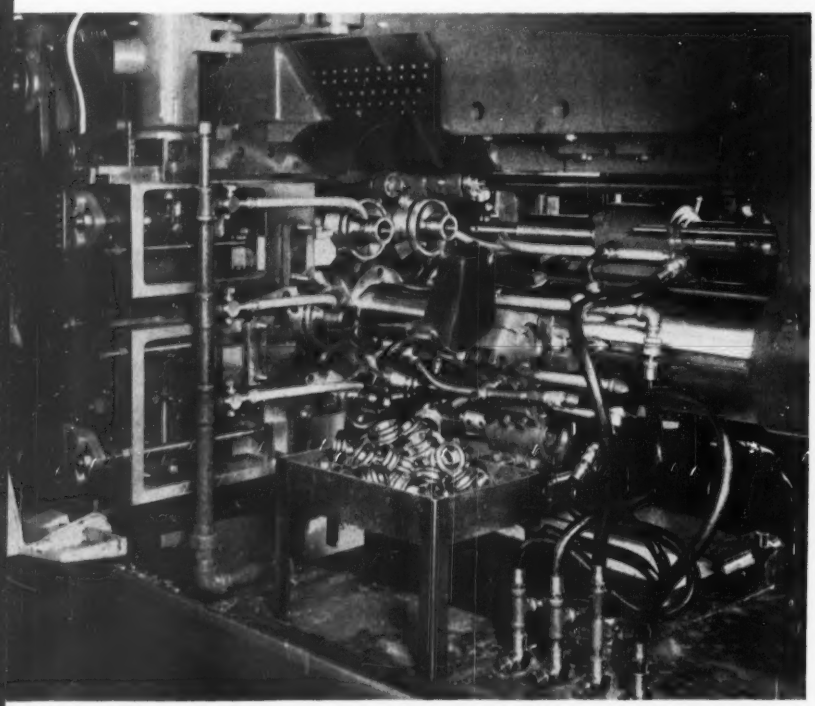


Fig. 3. Six-spindle automatic bar machine equipped with seven carbide tools for producing ball bearing inner races in 10 3/10 seconds per part.

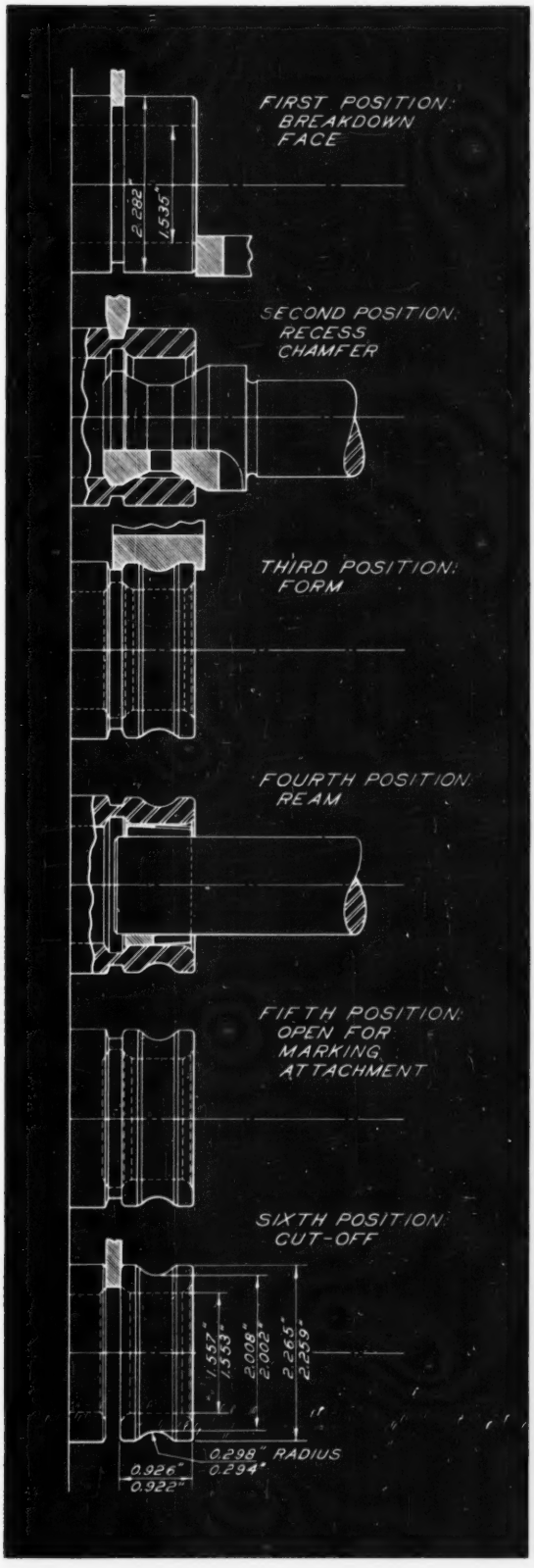


Fig. 4. Tooling lay-out for automatic shown in Fig. 3. All tools are carbide-tipped. Reamer located at fourth position is on auxiliary, accelerated-feed spindle.

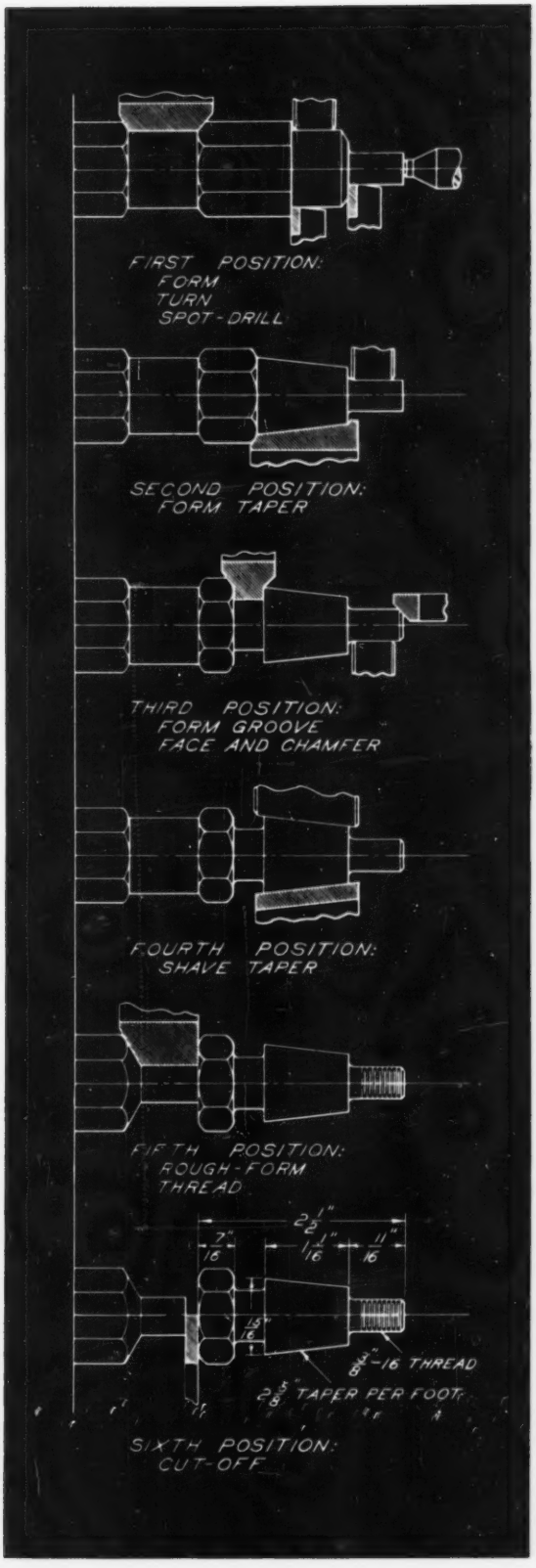


Fig. 5. Tooling lay-out for automatic shown in Fig. 6. Forming of taper at second position and shaving at fourth position eliminate grinding previously required.

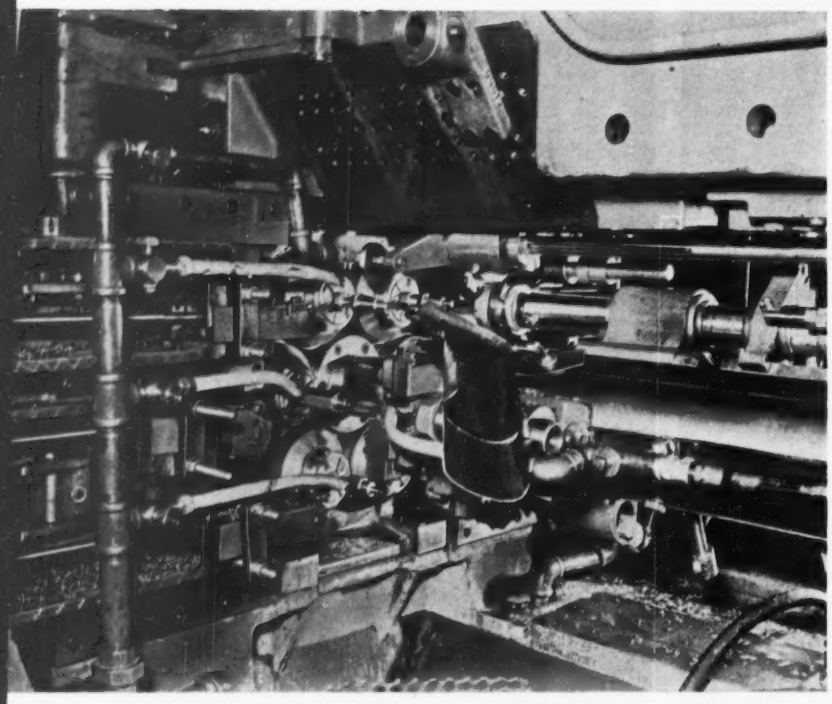


Fig. 6. Oil cocks are produced in 8-second cycle from 1-inch hexagonal bar stock made from SAE 1112 steel on this 1 1/2-inch, six-spindle automatic bar machine.

turning-tool tips, while Grade 370 is employed for all other tools except the spot-drill and thread chasers. The latter tools, in this case, are made from high-speed steel. Work-spindles are rotated at 1562 R.P.M. to provide a cutting speed of 450 feet per minute. All the cross-slide tools are fed at the rate of 0.0025 inch per revolution with the exception of the rough-forming tool at the fifth position, which travels 0.0017 inch per revolution. The main tool-slide, on which the turning, drilling, and facing tools are mounted, is fed horizontally at the rate of 0.0061 inch per revolution.

Trim cutting fluid, mixed with water in the ratio of 10 to 1, is used on this machine. Tool life for the various operations is 700 pieces per grind for the turning and facing tools, 500 for breakdown and rough-forming, 450 for taper-forming, 400 for grooving, 800 for shaving, and 350 for cutting-off.

Coolant, Tools, and Holders

Coolants played an important role on all three of the jobs described. Water-soluble cutting fluids did an effective job of cooling both the machine and cutting tools when cutting speeds were increased up to ten times. Since cooling was so effective, Cone engineers were able to decrease bearing clearances on the machines, and to adjust slides and carriers to closer tolerances.

Tool geometry, although most important, will vary depending on the application. It is considered too early in the carbide development program to make any recommendations with regard to optimum tool angles. However, full use is made of commercially available, standard-size carbide blanks.

Heavier, quick-change tool-holders are important in obtaining maximum production from the machine and full use from the carbide tools. For example, the dovetail form-tool holders are of substantial cross-section, and have only one side clamp and a bottom plate, each secured to the holder by two screws. Shaving attachments are equipped with back-up rollers.

* * *

Sandpaper-Making Improved by Sonic Techniques

Ultrasonics and electronics have been combined to improve the manufacturing of sandpaper. According to a report from The Carborundum Company, Niagara Falls, N. Y., ultrasonic waves, introduced into the adhesive mix, measure the sound-wave energy required to cause the layers of adhesive to slosh back and forth over one another. This energy, which is proportional to the viscosity of the mix, is calculated by an electronic computer. The data are fed to a special electronic recording-controlling instrument, designed by Minneapolis-Honeywell engineers, which automatically maintains the viscosity of the fluid at the proper level. If the mix becomes "heavy," the electronic instrument dilutes it just enough to bring it back to normal.

INGENIOUS *Mechanisms*

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Modified Eccentric Provides Rest Interval

By L. KASPER, Philadelphia, Pa.

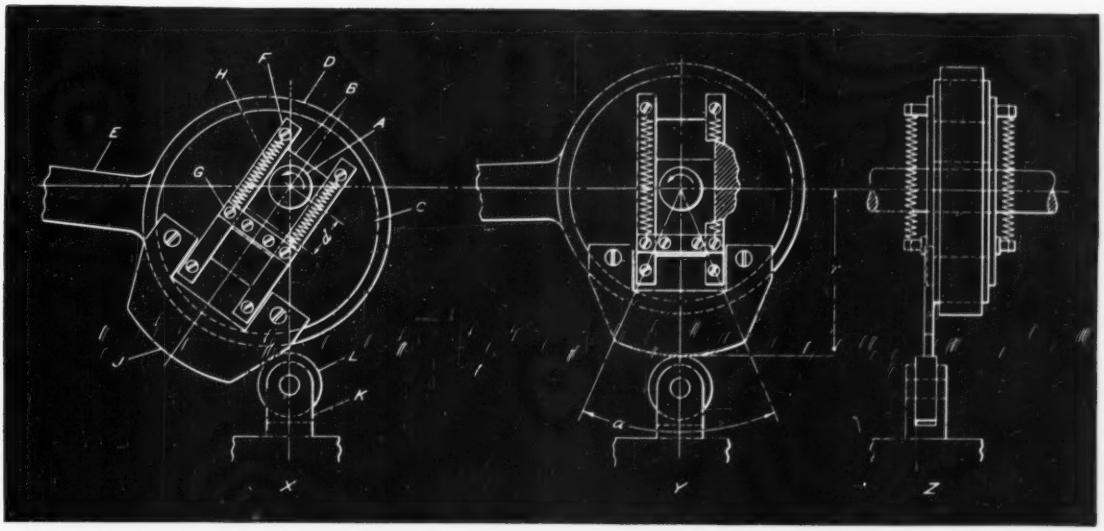
In the fabrication of a wire product, a slide-actuated mechanism was required to transfer the part being made from a loading station to a work station, and then to an unloading station. The part was to be loaded on the forward stroke of the transfer slide, and unloaded on the return stroke. It appeared that a rotating eccentric disc offered the simplest method of moving the slide. This did not, however, prove entirely satisfactory because the velocity of the slide was too great when passing the unloading station to permit foolproof discharge of the part.

The difficulty was overcome by modifying the eccentric mechanism to provide a rest interval at the mid-point of the return stroke without otherwise affecting the work cycle. The drawing illustrates the mechanism that proved satisfactory. Side views of the device are shown at X and Y and an end view at Z.

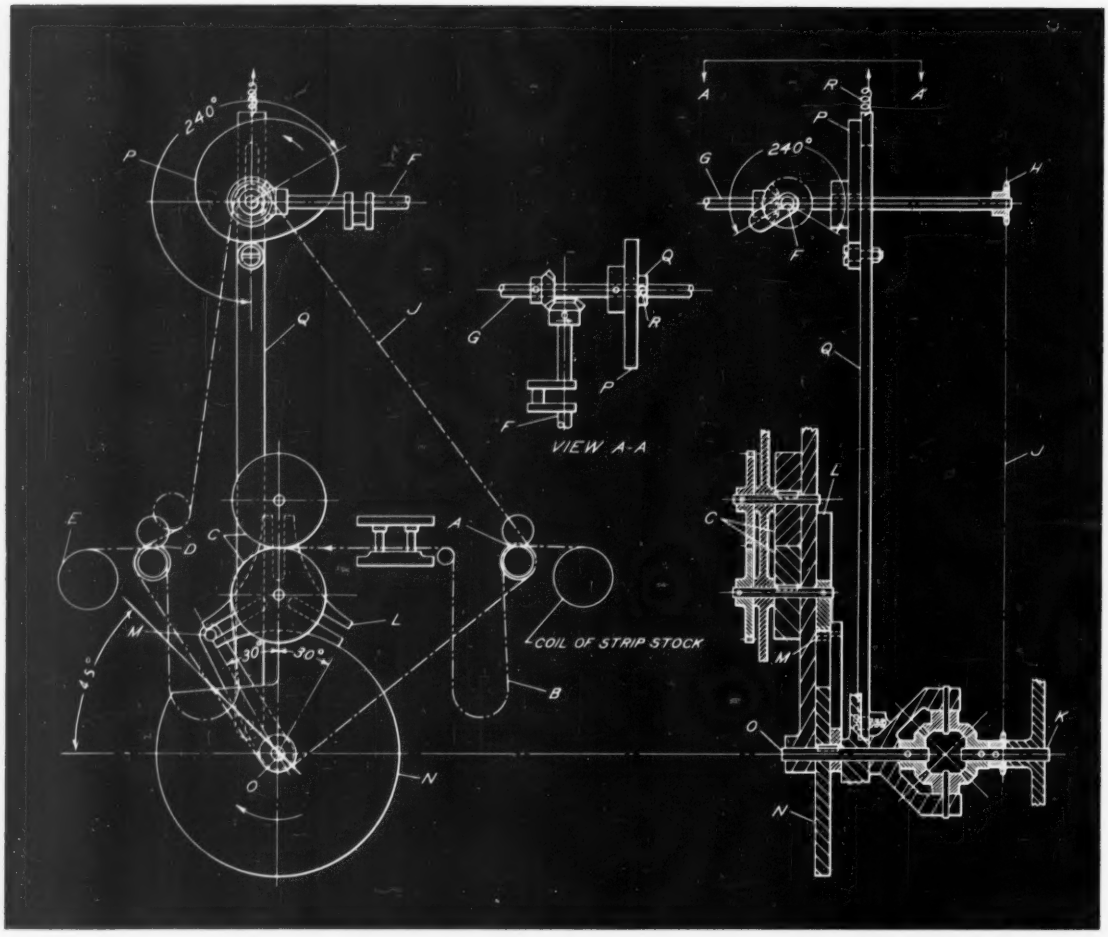
The shaft *A* which drives the mechanism is supported on bearings, not shown, and rotates in the direction indicated by the arrow. Keyed to this shaft is a block *B* fitting a rectangular area cut through a disc *C*. Encircling the disc is a strap *D* integral with the rod *E* which extends to the transfer slide. Keeper strips *F* maintain the block in alignment with the disc. On the long end of each side of the block is a bar *G* carrying studs to hold springs *H*. The opposite ends of these springs are anchored to studs attached to the keeper strips.

A cam-plate *J* is fastened to one face of the disc. The greater part of the periphery of the cam-plate forms an arc of a circle having a center coinciding with that of the disc. Supported on a stationary bracket *K* is a roller *L* with which the cam-plate comes into intermittent contact during the functioning of the mechanism, and thus sets up a rest interval.

In view X, the disc center is offset from the shaft axis by the distance *d*, being in effect a conventional eccentric arrangement. The springs serve to keep the block at one end of the rectangular area in the disc. In the position shown, the rise section of the cam-plate has just con-



By having the center of disc (C) momentarily coincide with the axis of shaft (A), a rest interval is introduced in the action of this eccentric mechanism.



Cam-controlled differential mechanism combined with Geneva movement to provide a high-speed feed for punch presses

tacted the roller. Further rotation of the shaft causes the roller to act on this section, creating a movement of the disc center toward the axis of the shaft.

As can be seen in view Y, the curved section of the cam-plate next bears on the roller. (The vertical position of the bracket is such that distance r corresponds to the radius of the cam-plate). During this period, the axis of the shaft and the disc center coincide, so no movement is transmitted to the eccentric strap and its rod. Thus, during the rotation of the shaft, the transfer slide remains a complete rest for an interval determined by the magnitude of angle a.

The radial position of the block and cam-plate on the disc is, of course, arranged to time the rest interval to the desired point in the return stroke of the slide. As the shaft continues to rotate, the contact of the cam-plate with the roller is terminated, and until contact is again made, the mechanism operates in the manner of an ordinary eccentric.

High-Speed Punch Press Feed Mechanism

By B. Spector, Jamaica, N. Y.

Unlike the conventional feeding mechanisms provided on punch presses that utilize one-half the crankshaft rotation for their operation, the device illustrated functions through a span of 240 degrees. This feed mechanism enables a strip-fed, short-stroke punch press to be converted to a high-speed automatic machine.

With power feeding mechanisms, the intermittent motion as well as the necessity of overcoming the inertia of the coiled stock each time a feed movement occurs, limits the speed at which the material may be fed. These speed-retarding factors have been eliminated in the device here described.

The strip stock is threaded between sprocket-driven rollers A, leaving loop B, and then over a small idler pulley and through the die. From the die, the material passes between feed rollers

C, leaving a second loop, then through another pair of sprocket-driven rollers D, to be finally wound on friction-driven reel E. The length of each of the two loops is slightly greater than the required feed per stroke. Rollers A and D are equal in circumference to the length of the required feed, while the circumference of feed rollers C is three times as large.

A pair of miter gears transmits the rotary motion of crankshaft F to drive-shaft G. This drive-shaft is positively linked, by means of sprocket H and chain J, to the sprockets on rollers A and D, and also on shaft K of a differential mechanism. All four sprockets are of the same diameter.

The mechanism is designed so that 240 degrees of each crankshaft revolution is apportioned for feeding; the remaining 120 degrees of the cycle is utilized for the punching or forming operation. Intermittent rotation of the three-branch Geneva wheel L actuates the main feed rollers. Movement of the wheel is controlled by arm and roller M, and by locking sector N. One-third of a revolution, or a 120-degree movement of the Geneva wheel, will feed the stock the required amount.

The roller on driving arm M enters a slot of the Geneva wheel at a right angle. Therefore, with the slots spaced at 120-degree intervals, and the roller entering at an angle of 90 degrees, it follows that the driving arm must be situated 30 degrees from the vertical center line as shown. From this it may be noted that a total angular displacement of 60 degrees is all that is necessary of the driving arm and the shaft O, to which it is keyed, in order to complete one feeding cycle of the stock. To spread this 60-degree motion over 240 degrees of crankshaft rotation, a differential gear mechanism, coupled to a cam, is employed.

Cam P is keyed to the drive-shaft and is designed with a simple harmonic rise through 240 degrees, and a return through the remaining 120 degrees. As the drive-shaft rotates in the direction of the arrow in the illustration, shaft K is driven at the same speed. In coordination with this movement, the differential housing is rotated in the same direction as shaft K by the action of cam P on rod Q. The rod is attached directly to the differential housing. By designing the cam to move the housing 90 degrees during a 240-degree rotation of shaft K, a total of 180 degrees of rotation will be lost to shaft O. In this way, only the 60 degrees necessary to index the Geneva wheel will be transmitted through the differential mechanism during the 240 degrees of crankshaft rotation used for feeding.

The opposite effect is produced by the differential during the last 120 degrees of cam rotation during which the punching or forming operation is being performed. As rod Q rises —due to tension spring R forcing the roller to follow the cam contour—the housing is moved in the opposite direction and shaft O is accelerated. This brings driving arm and roller M around to the starting position for the next cycle.

* * *

Multiple-Spindle Keller Cuts Machine-Hours

More and better production is being obtained at Chance Vought Aircraft, Dallas, Tex., by means of the multiple-spindle Kellering machine seen in the accompanying illustration. The aluminum castings shown were previously machined on a single-spindle vertical milling machine. Machining time per part ran approximately sixty-five machine-hours.

When the three-spindle Kellering machine was originally obtained, the parts were first checked on a single-spindle Keller to test the templates and operation. They are now aligned on the multiple-spindle machine and secured in about four machine hours. The cutters employed are two- and four-lip end-mills in a matched set. The three parts are Kellered in approximately forty machine-hours per part.

There is no difference in surface finish, and the same close tolerances are maintained. To place the finished part into assembly requires only turning, slotting, and other minor operations that cannot be done on the Keller machine.

Time required to machine aluminum castings was reduced from sixty-five to forty hours per part by employing this multiple-spindle Kellering machine.



TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Special Clamp-Screw Mounting Simplifies Extraction

By W. M. HALLIDAY, Southport, England

In many drill jigs and milling fixtures, the work-piece is retained by means of one or more simple clamp screws that are threaded through either cast bosses or the side walls of the jig body. Such screws are usually arranged to hold the work against integral ledges or locating pins in the body. A typical example is shown in Fig. 1, where *A* is the cast-iron jig body and *B* is the clamping screw.

Screws of this kind are usually made of hardened tool steel to obviate wear, especially at the contact tip. Not infrequently the shanks of long screws become distorted, as shown at *C*, or mushroomed as shown at *D*, as a result of applying excessive gripping pressure on the work. Such damages make adjustment very difficult, and at some point the screw may seize in the hole.

When jamming occurs, the defective screw must be replaced. Often a damaged screw must be softened with a torch so that the mushroomed end may be sawed off, or the seized portion drilled out of the threaded hole. To avoid these difficulties, the adaptation illustrated at Y in Fig. 2 was employed.

The original hole in jig body *A* was enlarged to approximately twice the diameter of the screw and retapped. Into this hole is threaded the hardened-steel split-sleeve shown at X in the diagram. Two flats are machined on the head of this sleeve to accommodate a wrench. The two halves *E* and *F* are separated by copper or brass strips *G* of the same thickness as the saw used to split the sleeve. These strips are soldered to one sleeve. A snap-ring *H*, seating in annular groove *J*, holds both halves of the split sleeve in alignment. The clamping screw is threaded through the tapped bore of the sleeve.

Should the screw bend or mushroom and so require removal, it is merely necessary to unscrew the sleeve as a single unit with the damaged screw in place. The spring clip is then pried out of the annular groove, and the halves of the split-sleeve are separated to release the screw.

When installing a new screw, halves *E* and *F* are aligned with each other on the threaded

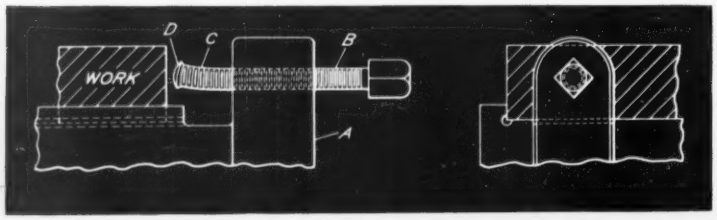


Fig. 1. (Left) Bent or mushroomed screws are very difficult to remove from this conventional clamping device.

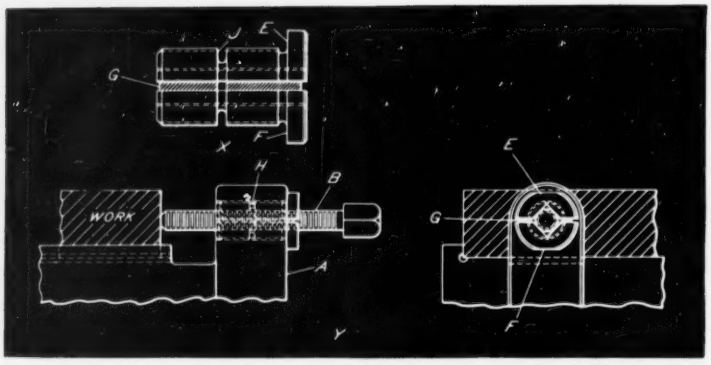


Fig. 2. (Right) Adaptation of clamping device seen in Fig. 1 employs the split-sleeve, view X, for simplified removal of damaged screws.

shank and the snap-ring is replaced in the groove. The entire assembly is again screwed into the threaded hole in the jig.

Turn-Milling on a Standard Horizontal Milling Machine

By Clifford T. Bower, London, England

Turn-milling is a procedure involving the rotation of a work-piece in contact with a rotating milling cutter, or gang of cutters. This process may be used to advantage in machining interrupted surfaces such as gear segments and other partly circular components. Grooves can be finished in one revolution of the work by plunge-cutting with a cutter of appropriate width. The numerous cutting edges on a milling cutter assure a longer life than could be expected from a single-point turning tool.

The work-piece *V* shown in Fig. 1, part of the kick-starting mechanism on a motorcycle, is a steel forging. While turning the parts on a turret lathe, it was found that the interrupted surface of the gear segment caused the cutting edges of the turning tools to deteriorate rapidly so that tool maintenance time was high. Turn-milling was then successfully employed for rough-machining all the diameters and faces indicated in Fig. 1, using the power-driven device shown

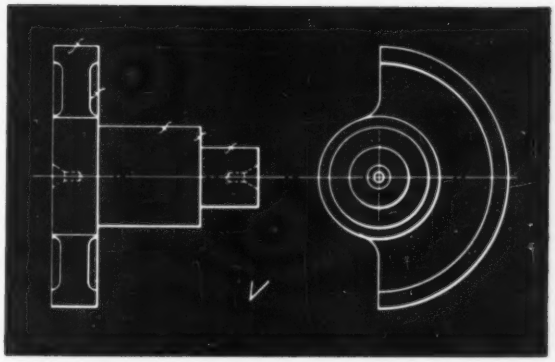


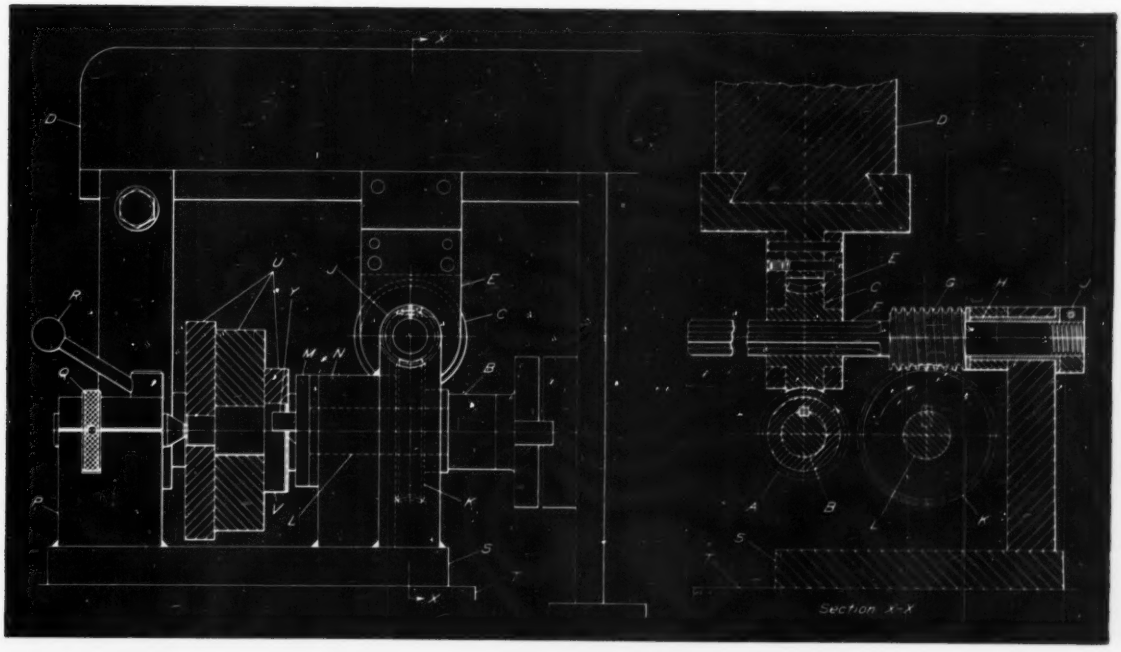
Fig. 1. Diagram of forged-steel gear segment, indicating surfaces machined in one operation by turn-milling.

in Fig. 2. Prior to turn-milling, the forging is centered at both ends.

Since this process requires that the work be revolved, the driving arrangement seen in Fig. 2 is coupled to the horizontal milling machine mandrel. Worm *A* is secured to the horizontal cutter mandrel *B* in a manner similar to that used for mounting the cutter spacing collars. The worm meshes with a bronze worm-wheel *C* which is suspended from the over-arm *D* by means of a bracket *E*. This bracket is built up from an anchor block and two side-plates.

Rotation of the worm-wheel *C* is transmitted to the horizontal splined shaft *F*, which can slide axially within the bore of the worm-wheel. Integral with the splined shaft is a second worm *G*.

Fig. 2. Turn-milling attachment incorporating a double worm-gear reduction designed for a standard horizontal milling machine



The worm and its splined shaft are supported in a bearing *H* and retained by means of split nut *J*, thereby allowing the endwise slack between the shaft and its bearing to be taken up. Rotation from the second worm *G* is transmitted to the worm-wheel *K* which is secured to the end of the work-spindle *L*. It is apparent that the foregoing arrangement is in the form of a double-reduction worm-gear enabling the work-spindle to be rotated by the milling machine cutter mandrel at a slow relative speed. The splined shaft permits the work-spindle to be moved either toward, or away from the cutters.

A flat circular plate *M*, with an integral headstock center, is fitted to the work-spindle *L*. The spindle is housed within a solid-steel headstock block *N*. The drive is transmitted from the work-spindle to the work-piece *V* by means of a pair of block-shaped dogs *Y* on the circular plate *M*. These dogs engage the diametral flat on the gear segment. Clearance is provided between the dog faces and the flat on the gear segment to allow for deviations in the forgings. Therefore, only one of the dogs is in driving engagement during the turn-milling operation. The second dog merely prevents the work-piece from swinging on the centers during loading.

A tailstock block *P* carries a carbide-tipped center. This allows a firm pressure to be applied to the work and eliminates the dangers of scoring and seizing of the tailstock center and the center hole in the parts. The tailstock center has a parallel shank threaded externally which engages a ring nut *Q*. The center can be advanced into the work by rotating the ring nut. A horizontal split on one side of the tailstock block can be clamped together by means of clamp *R*, thus gripping the tailstock shank firmly. The headstock and tailstock blocks, or housings, are welded to a steel baseplate *S* which is bolted to the machine table *T*. This mounting enables the operator to advance or retract the work-piece in relation to the cutters during the operation by traversing the table.

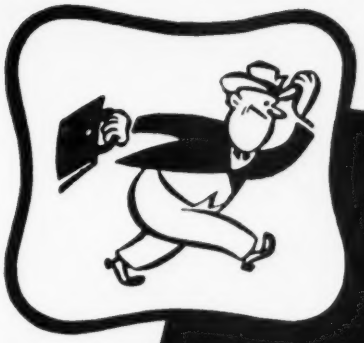
In use, the table is unlocked and moved longitudinally by means of the quick traverse to bring the work away from the cutters. The tailstock center is unlocked and retracted by means of the ring nut *Q* so that the work-piece can be removed. A new work-piece is then locked between the centers and the table advanced toward the cutters. The cutters *U* are fed into the work *V* by hand until the correct depth has been reached; then the table is locked in position. One revolution of the work in contact with the cutters is sufficient to machine the three diameters and two faces to size.

The mandrel speed is governed by the peripheral speed of the largest-diameter cutter, while the feed, or revolutions per minute of the work-piece, is governed by the chip load per tooth of the smallest-diameter cutter. Therefore, the speed reduction between the mandrel and work-spindle must be controlled closely in the design of the worm gearing to obtain satisfactory cutter life.

Climb-milling has proved very satisfactory for this set-up due to the small amount of backlash in the worm-gear drive, thus avoiding the tendency for the cutter to grab at the work. In climb-milling, the surface of the work being cut is moving in the same direction as the teeth doing the cutting, thereby subjecting the gear train to far less strain than would be experienced if it were called upon to drive the work against the cutter rotation.



These Ampco Grade 24 centrifugally cast rings and solid and rectangular bars represent a small portion of those which have been made available for "off-the-shelf" delivery by Ampco Metal, Inc., Milwaukee, Wis. When these blanks are employed in press operations where stainless steel is being worked, their use results in a finish which has no scratch or draw marks.



The Sales Engineer and His Problems

By BERNARD LESTER
Management Consulting Engineer
New York

Return to Old-Time Selling Methods?

THERE is a common expression, "A chicken should never discuss his own soup." But self-appraisal helps, especially when so many express the desirability of getting back to old-fashioned methods of selling. Undoubtedly some of the sales methods used in bygone times would be effective today, but it must be recognized that the requirements for successful selling have undergone a profound change.

Old-Fashioned and Modern Selling Methods

The old-time salesman was a rugged individualist, strong in personality and operating on his own with a flush and ready wallet. As one experienced friend used to put it: "I just get the prospect 'buttered up,' make him a pal, and tell him not to worry about product details. What I do is just make him want to buy from me."

Selling has taken on a new form today. Though we still must make the prospect "want to buy from me," the scene has changed. Witness the facts that more and more buyers are technically trained men, and that product, process, market, and competition have become vastly more complex. The sales engineer must be a businessman and engineer bundled in one.

The lubricant of friendship is still essential to the selling of industrial equipment, but "oil" alone won't make any mechanism work!

How Will You Stand Up When You Meet Real Competition?

Some salesmen are folding up because keen competition is with us right now. A market certainly exists, but meeting its needs has grown more difficult. To successfully meet today's competition requires a vastly larger storehouse of knowledge. It can best be met by knowing more than our competitors, offering facts to meet the case in hand, and applying them in a gracious and engaging way to help the multiplying personnel who influence the purchase.

How Are You Tough and Aggressive?

Toughness and aggressiveness in selling technical products no longer depend on brazen self-confidence, fast talk, and an overpowering personal appeal. Present-day markets call for assurance, courage, and persistence—all based on comprehensive knowledge.

Is Selling Always the Same?

People often say that selling is the same, whether you are proffering shoes, insurance, or machinery. This statement is two-sided—true and false. The principles of interchange in human relations hold true in all forms of selling, to the end that we make our product or service "easy to buy from me." We should never deny the common bond to all sales techniques expressed through personality.

But there is a wide difference between selling stock consumer goods and industrial equipment. Success rests on a substantial foundation of knowledge and wisdom, by which each sales engineer builds his own personality as an individual. With the increasing complexity of customer problems, the sales engineer needs breadth and depth to support his personal resources. More and more he must act on his own.

An opinion survey on advertising made last year by George Gallup illuminates present-day buying interests. This survey revealed that prospective purchasers are growing thoroughly weary of shallow sales tactics. Boastful statements and lack of proof are becoming taboo. Above all, people tire of continually being enticed to listen to irrelevant attention-getting stunts and distorted statistics.

Don't completely focus on a return to *old* selling methods, but rather develop a better selling philosophy based on knowledge and skill to meet the demands for today's conditions. Under certain conditions, a combination of new and old methods may bring optimum results.

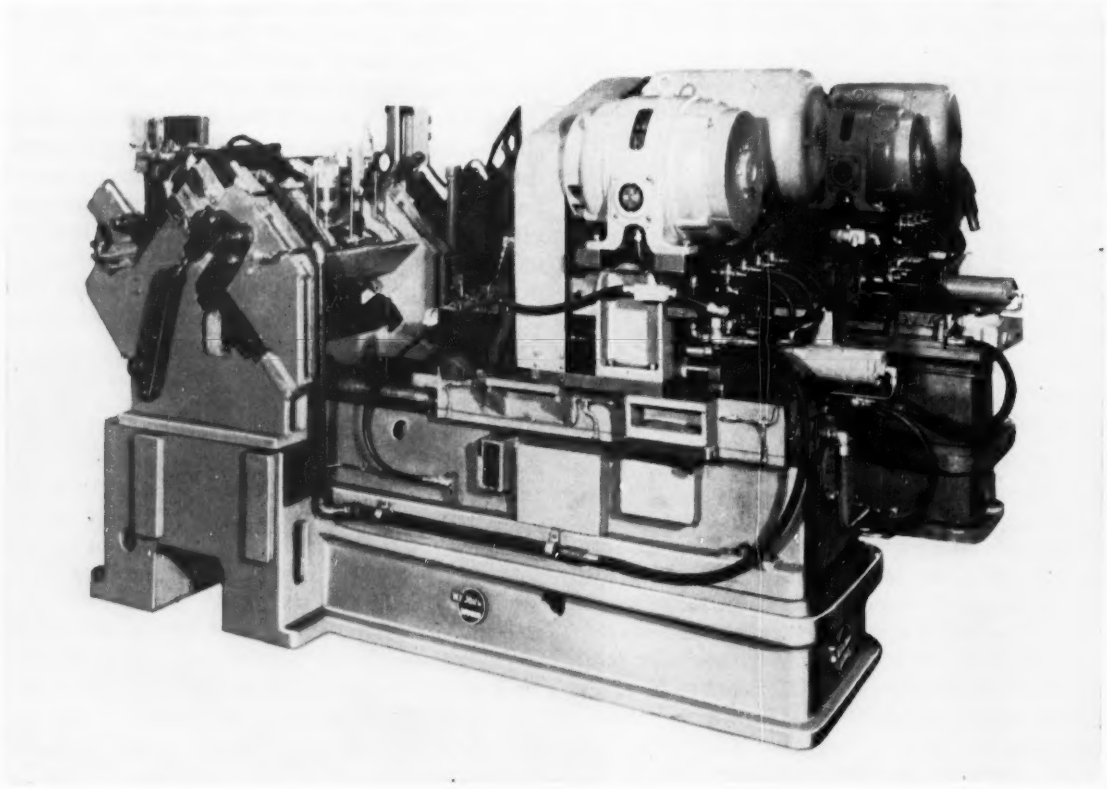
LATEST DEVELOPMENTS IN *Shop*

W. F. & John Barnes Special Automatic Production Boring Machine

A new method of tooling developed exclusively by the W. F. & John Barnes Co., Rockford, Ill., has been incorporated in a special machine brought out by this company for finish-machining valve seats and stem holes in the cylinder heads of car and truck engines. This automatic progressive through-transfer type machine is said to consistently maintain the concentricity between the finished valve stem hole and seat within 0.0005 inch (total indicator reading). An exceptionally fine finish is also said to be obtained in both the stem hole and in the seating surface for the valve.

The gross production of the machine illustrated in Fig. 1, is 120 cylinder heads per hour. One of these heads is shown in Fig. 2. The specialized tooling equipment of this machine consists primarily of multiple-blade tools for forming the valve seats, and of modified gun drilling tools for boring the valve guide holes. The special tools for finish-machining four valve seats and stem holes in one pass may be seen in the close-up view of the machine head in Fig. 3. A second four-spindle head completes the remaining valve seat and stem hole machining operations in the V-8 cylinder heads. Coolant is applied to the valve stem boring tools. Any finish from 20 to 100 micro-inches can be pro-

Fig. 1. W. F. & John Barnes special automatic boring machine for processing V-8 cylinder heads, equipped with clamping and transfer mechanism for installation in a continuous machining line



For more information on these products, use Inquiry Card, page 241

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

duced, and the holes can be machined straight and to size. The seat apex tolerance on this job is 0.0015 inch.

Performance tests have shown that the special carbide tools employed for this work will produce 15,000 or more precision valve seats and 2000 stem holes before regrinding or tool changes become necessary. During trial production runs, a breakdown test showed that the multiple-blade seating tools would produce over 30,000 parts, and the gun-boring tools between 2500 and 4000 parts before breaking down. However, on the seating tools at the 30,000 mark, considerable cratering was shown; therefore, it is believed that the economical tool life of seating tools is in the neighborhood of 10,000 to 15,000 parts per grind without necessitating a considerable amount of regrinding on the carbide tips. In the same tests, it was found that a fair estimate of tool life on the gun boring tools would be approximately 2000 parts without necessitating time out for regrinding.

The unusual precision maintained in actual production by the new machine and tools is believed to make it possible to substantially modify the 100 per cent inspection system previously employed. In general, work-handling, physical effort, and production costs will be considerably reduced. 101

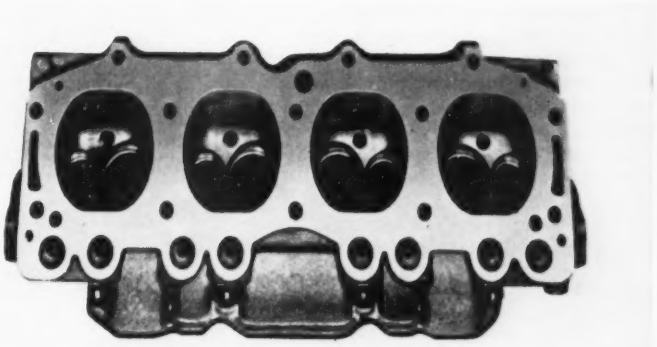


Fig. 2. (Above) Cylinder head of V-8 engine with valve seat and guide holes of the type finished to precision tolerances on machine seen in Fig. 1

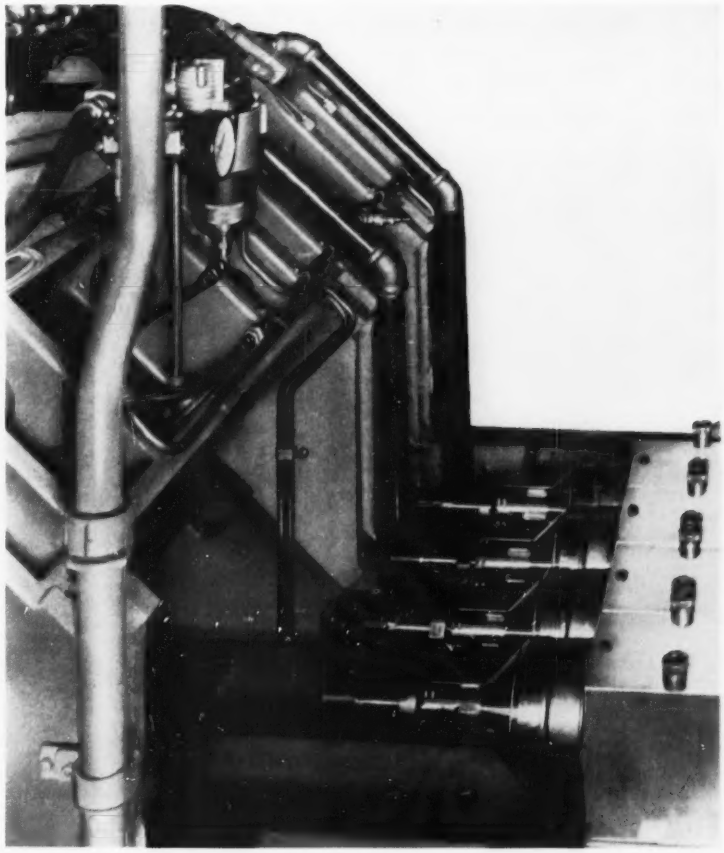
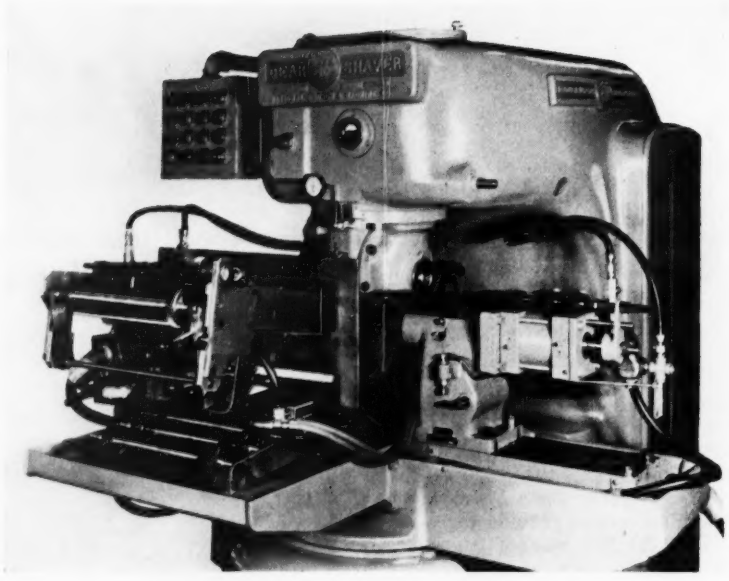


Fig. 3. (Right) Close-up view of head and special tools of W. F. & John Barnes machine for finish-machining four valve seats and stem holes in one pass

Automatic Work Loader for Gear Shaving Machines

A new type of "Red Ring" automatic loader for handling long-shaft, unsymmetrical gears on standard rotary shaving machines is announced by the National Broach & Machine Co., Detroit, Mich. The loader has a built-in gaging device, a magazine feed, air-powered loading fingers, and a discharge chute that feeds the finish-shaved parts to the unloading position in front of the operator.

A specially designed set of lever type trip-fingers in both the input magazine and discharge chute keep the gears from touching each other and prevent cocking or jamming of the parts. Operation of the loader is completely automatic when used in conjunction with a standard rotary gear-shaving machine equipped with suitable controls and an air-powered tailstock, shown in the illustration.

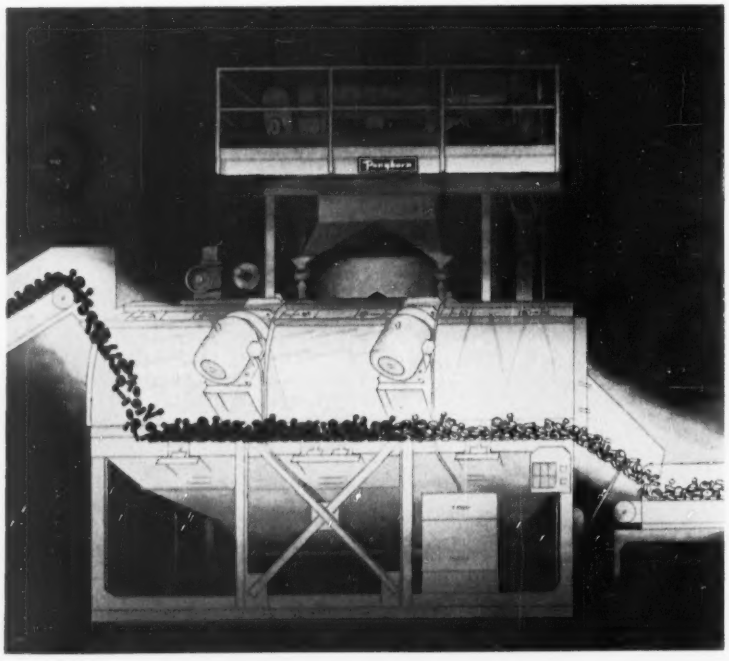


"Red Ring" automatic loader for gear-shaving machine

The loader shown handles a 14 diametral pitch gear having an outside diameter of 3 1/4 inches and a width of 1 inch with an integral shaft 17 1/2 inches long, at the rate of 180 gears an hour. This loader is available in a variety of sizes designed to suit specific long-shaft gears. 102

Pangborn Continuous-Flow Cleaning Barrels

The Pangborn Corporation, Hagerstown, Md., has announced five Type GO continuous-flow Roto-blast cleaning barrels ranging from the No. 1 size, which has a drum 48 inches in diameter, to the No. 5 with a drum 72 inches in diameter. These barrels are adapted for use in foundries planning for a maximum amount of automatic operation. They can be installed so that conveyors bring castings from the shakeout and cooling conveyor directly into the barrel through which they are continuously moved while being tumbled and blast-cleaned. All abrasive is reclaimed before the cleaned castings are discharged.



Visualizing the operation of a Pangborn continuous-flow cleaning barrel

Because of the numerous variations possible in shape and size of castings or forgings which can be cleaned in these machines, the cleaning capacity rating is usually given in cubic feet per hour. Another vital specification of this machine is the maximum dimension of a piece which can be cleaned in the barrels.

The No. 1 barrel, for example, will clean 50 to 60 cubic feet of 11-inch gray-iron castings per hour or 30 to 40 cubic feet of 11-inch forgings. The drum of this machine is driven by a 2-H.P., 1200-R.P.M. motor and the Roto-blast wheel by a 20-H.P. motor. The largest barrel will handle from 300 to 400 cubic feet of 26-inch gray-iron castings or 150 to 250 cubic feet of 26-inch forgings per hour.

The rotating drum of this machine is driven by a 10-H.P., 1800-R.P.M. motor and the Roto-blast wheel is operated by two 40-H.P. motors. 103

For more information on these products, use Inquiry Card, page 241



Special automatic machine for processing shells which was built by the Snyder Tool & Engineering Co.

Snyder Special Machine for Processing Shell Casings

A seven-station automatic cycle machine, designed for processing 155-millimeter shell casings, is announced by the Snyder Tool & Engineering Co., Detroit, Mich. A feature of this machine is the method of feeding coolant through hollow spindles and central tube openings in the tools. This arrangement is necessary because the machining operation consists of processing the burster tube recess located in the base of the shell, opposite the threaded throat in the nose of the shell.

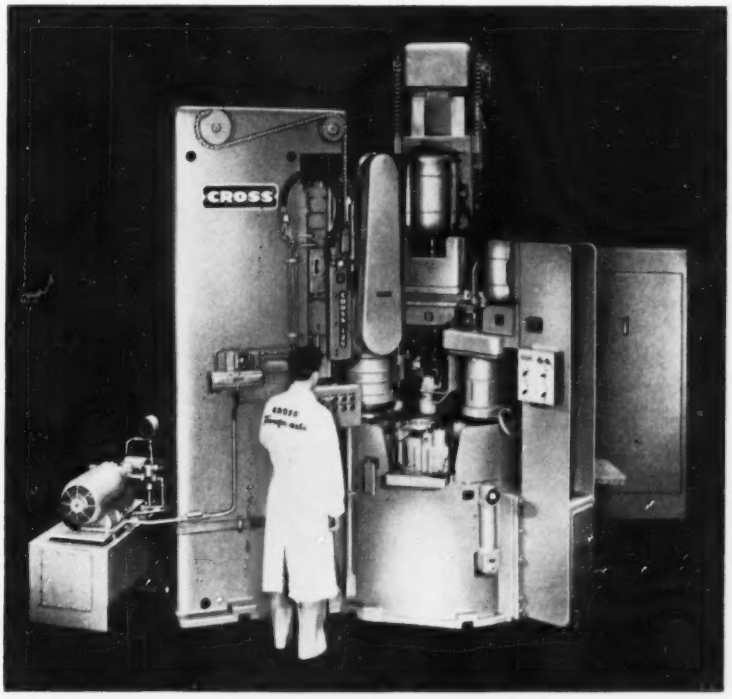
The only practical access to the burster tube is through the throat, and since the shell casing is approximately 22 inches long and 6 inches in diameter, the tools must reach into the shell cavity and operate, unsupported, for a distance of about 20 inches. In these circumstances, the hollow spindles and tool openings provide an effective means of delivering an adequate flow of coolant to the cutting tools. The high-speed steel tools operate at a maximum surface speed of 70 feet per minute with an infeed of 4 inches per minute, and have a stroke of 25 inches.

The operator rolls the shell down a slight incline against a stop at the first, or loading, station. The index mechanism then lifts the shell and carries it to the second station, where it is automatically located and power clamped by pressure against each end. The supporting yokes then fold down to clear the shell when the index mechanism is returned. Operations at the five working stations include drilling, counterboring, countersinking, and reaming. The shells leave the unloading station by rolling out of the machine along a ramp.

The working cycle is entirely automatic. The machine is completely interlocked, electrically, to protect both the operator and equipment. All indexing, locating, and clamping motions are accomplished by hydraulic cylinders. Coolant is supplied from a separately mounted tank and pump. After the machining operations have been completed, coolant and cuttings are removed by means of a hydraulic mechanism which tips up the shell and empties it through the nose. Production is at the rate of 133 pieces an hour. The base and column are of welded-steel construction. The floor space required is 135 by 145 inches. 104

Cross Special Dial Type Processing Machine

A dial type special machine designed to bore, drill, ream, and tap aluminum transmission shaft support castings has been announced by The Cross Company, Detroit, Mich. This machine also turns the rear face, counterbores the large pilot diameter, and performs chamfering operations on



Special dial type machine announced by The Cross Company

the castings. Production is at the rate of 128 castings per hour.

The index-table has six stations and is fluid motor-driven. One station is used for loading and unloading, the other five being working stations. Work-holding fixtures are operated by hydraulic power. Provision for complete interchangeability of all standard and special parts facilitates maintenance and serves to reduce the "down" time.

Other features include hydraulic feed and rapid traverse, hardened and ground ways, a filter equipped coolant system, and automatic work cycles. Construction is according to Joint Industry Conference standards. 105

Peerless Machine for Processing Transfer Plates of Automatic Transmissions

A two-way machine with a 14-inch vertical-way hydraulic-feed unit, a welded-steel tapping column, and a 24-inch, four-station automatic power indexing table has been built by the Peerless Production Co., Detroit, Mich., for processing automotive parts. This machine performs the drilling, chamfering, and tapping operations on transfer plates for automatic transmissions at the rate of 160 parts an hour. The tool equipment consists of a four-station fixture, thirteen-spindle drilling and chamfering head and an individual single-spindle No. 19 lead-screw tapping head.

Features of this machine include a multiple-spindle head of anti-friction bearing construction, with hardened gears and keyed drives; chromium-plated lead-screw type tapping spindle having hardened precision-ground threads; hardened, ground, and automatically lubricated ways; electrically controlled, modified Geneva type index-table designed for uniform acceleration and deceleration of indexing movements; and hydraulic and electrical installations to J.I.C. standards. 106

Portable Comparator for Extensometers

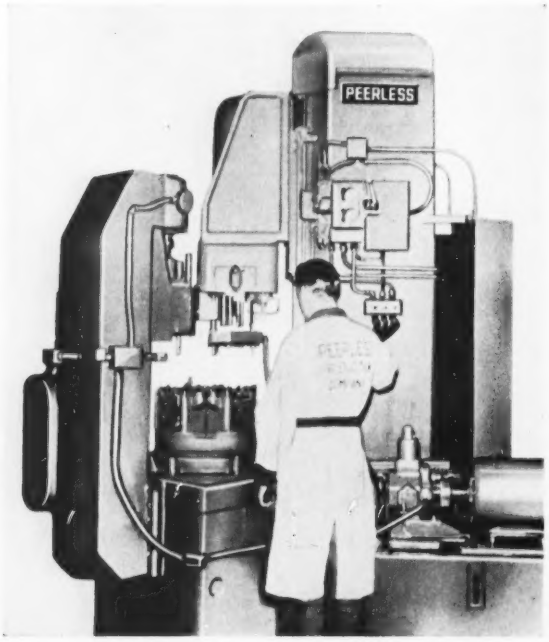
The Baldwin - Lima - Hamilton Corporation, Philadelphia, Pa., has brought out a new comparator for calibrating extensometers, compressometers, dial gages, and similar instruments (primarily those defined in ASTM Specification E83-52T as Class B type of instruments).

Outstanding features of this instrument are its small size and portability, and the elimination of mechanical linkages. This is accomplished by the use of a Microformer (miniature variable transformer) and null balance indicator to apply small displacements to extensometers with an accuracy within 0.000010 inch for calibration. The instrument weighs only 44 pounds as compared with 1200 pounds for a National Bureau of Standards comparator of a similar type.

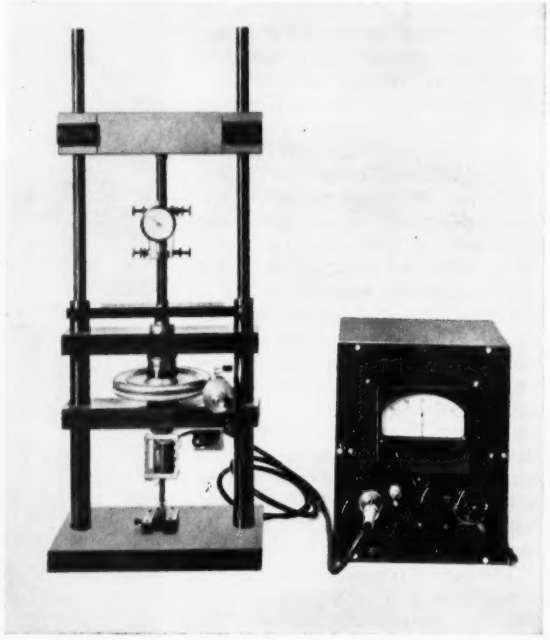
Extensometers having gage lengths up to 10 inches and ranges up to 0.250 inch can be checked by means of this comparator. Standard equipment includes adapters for extensometers used on 0.252-inch, 0.357-inch, and 0.505-inch diameter rounds. The indicator is operated from a power source of 110 to 120 volts, 50 to 60 cycles. The over-all dimensions of this comparator are approximately 25 by 10 by 7 inches. 107

"Triple C" Grinding Coolant

"Triple C" is a new grinding coolant being marketed by the Motch & Merryweather Machinery Co., Cleveland, Ohio. It is intended for all wet-grinding operations and may be put directly into water in the grinder where dissolving



Special machine for processing automatic transmission parts built by Peerless Production Co.

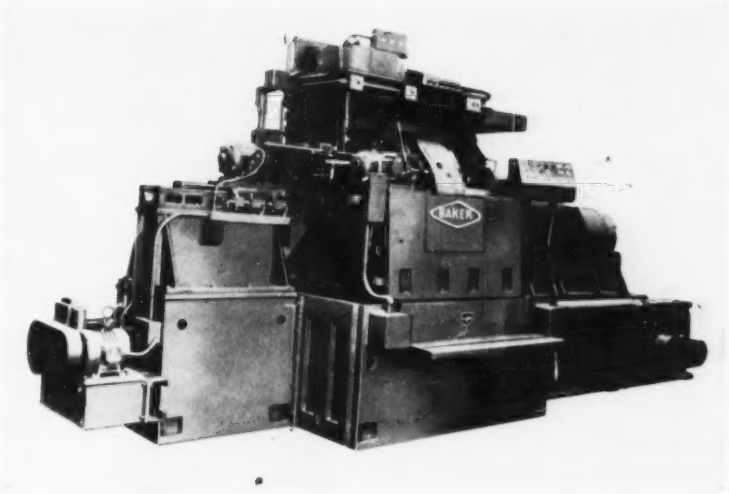


Baldwin-Lima-Hamilton announces extensometer comparator that incorporates a Microformer

For more information on these products, use Inquiry Card, page 241

can take place in as little as two minutes.

This coolant is compatible with heat-treating salts, makes stable solutions, and maintains its properties in even the hardest water. It does not impair filtration equipment operation or make ground materials slippery to handle when wet; is foamless and odorless. Solutions are transparent and dissipate heat quickly. They have no emulsifying action on oils or any detrimental effect on lubricated parts of machines. The grinding wheel stays clean and free-cutting. Disposal is said to present no problems since "Triple C" may be piped directly into streams without the possibility of contamination. 108



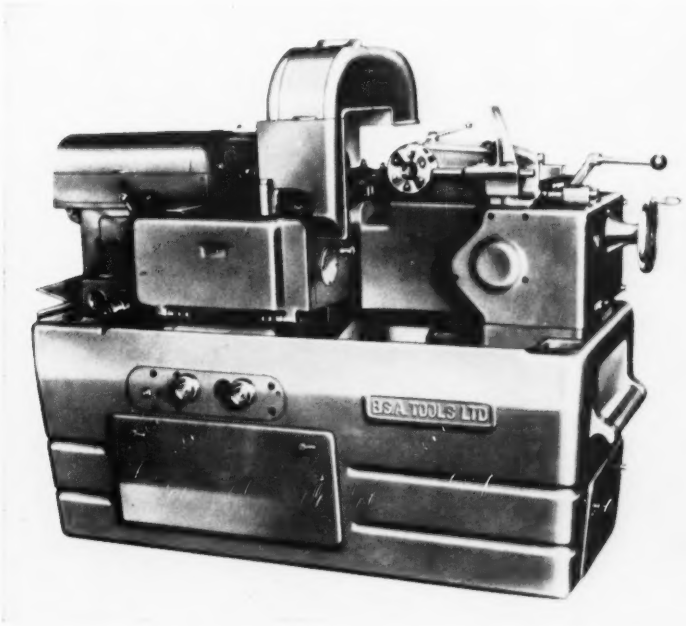
Four-station multiple drilling machine built by Baker Brothers, Inc.

Single-Spindle Automatic Screw Machines

The National Acme Co., Cleveland, Ohio, recently introduced in this country a line of single-spindle automatic screw machines built by B.S.A. Tools Ltd., Birmingham, England. This line includes five sizes of fully automatic machines covering a bar stock capacity range of from 1/2 inch to 2 inches. The No. 168L machine shown in the accompanying illustration handles bar stock 2 inches in diameter.

Outstanding advantages claimed for these machines include a wide variety of speeds with automatic speed changes, the structural rigidity needed to maintain high-speed precision operation, and greater convenience and safety for the operator.

Provisions for highly versatile tooling arrangements and quick change-over from one job to another make the machines well adapted to both long- and short-run production on a wide range of small parts. 109



B.S.A. single-spindle automatic bar stock machine has been introduced in this country by the National Acme Co.

Baker Four-Station Multiple Drilling Machine

An 85-HH hydraulic feed single-end machine having a four-station trunnion unit and an auxiliary single-spindle unit has been announced by Baker Brothers Inc., Toledo, Ohio. This machine performs multiple operations on floating pistons for Diesel engines, and will produce forty-one parts per hour. Mounted on a heavy end bed is a unit having hardened ways 30 inches wide fitted to a saddle 60 inches long.

The machine has an available feeding pressure of 23,500 pounds, and is equipped with an Oilgear variable delivery pump with an ample oil sump. The multiple head unit is arranged for direct drive from the main motor and has provision for pick-off gears for changing the spindle speeds.

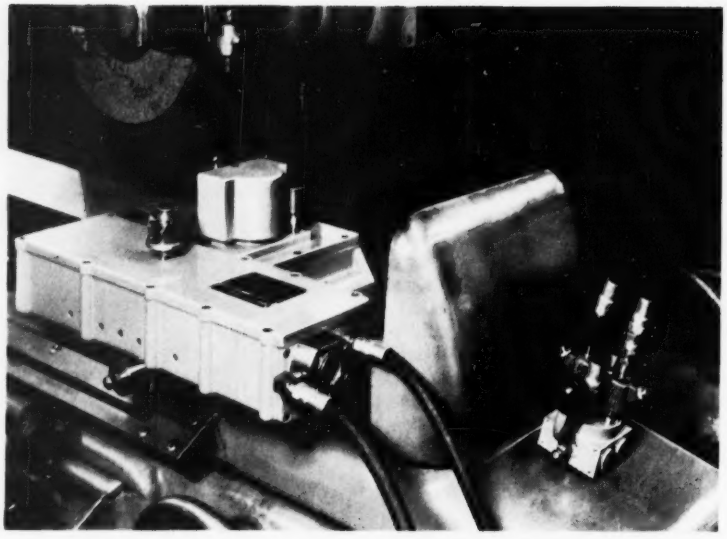
The auxiliary single-spindle hydraulic feed unit is provided for finish centering the dome end of the piston. The main unit has two feeds, and both units have positive stop, delayed reverse, and electrical cycle controls.

Hand indexing is achieved through a single control panel. At the first station, the work is loaded and unloaded. At the second station, a single-point tool semi-finishes the outer bore; and at the third station, the inner bore and counterbore are semi-finished and the bottom faced. The outside face of the bottom counterbore is also finish-faced and chamfered. The fourth station is equipped for finish-taper boring and recentering the dome. 110

For more information on these products, use Inquiry Card, page 241

Grinding Wheel Dresser

The Hoglund Engineering & Mfg. Co., Inc., Berkeley Heights, N. J., has introduced the Model 32 in its line of automatic grinding wheel dressers. This hydraulically operated dresser is designed especially for surface grinders. It can be used for any form that can be entered or followed by the diamond, and but little skill is required to operate the equipment. To set up for a new job, the operator simply removes the cover plates and changes contour templates. A hydraulic valve actuates the diamond movement across the wheel and speed control valves adjust the dressing speed. As with all other Hoglund dressers, accurate reduction is made from the enlarged template by using cams in the form of inclined planes. 111



Hoglund wheel dresser mounted on Thompson surface grinder

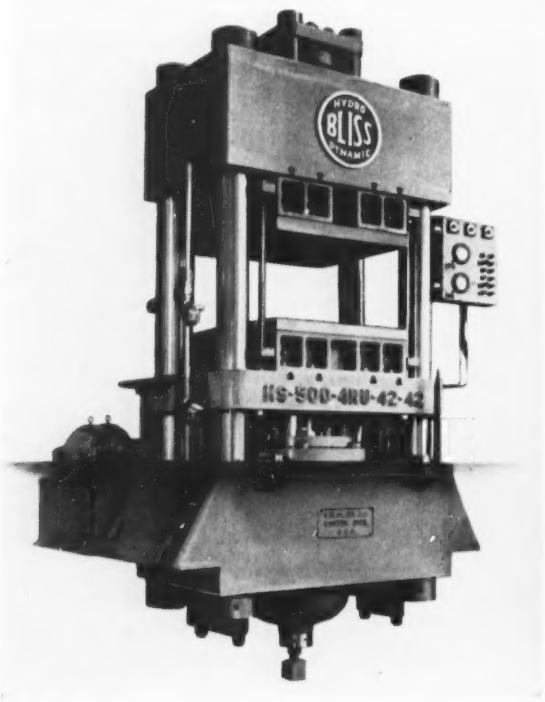
Hydraulic Molding Press for Plastic Parts

A 500-ton hydraulic transfer molding press for forming plastic parts in a closed die was recently completed at the Canton, Ohio, plant of the E. W. Bliss Co. Built with open tie-rod construction to facilitate handling, this press combines quick advance and slow pressing speeds with precise pressure controls for the forming of complex plastic structures.

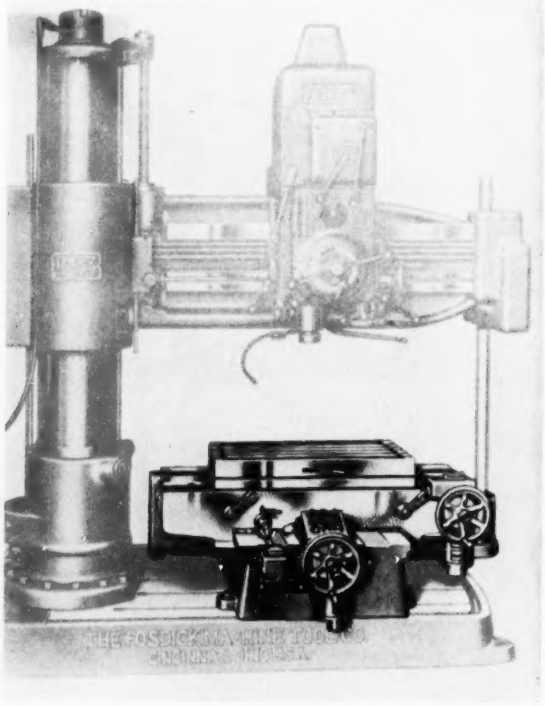
Plastic preforms are manually loaded into a transfer cavity, then moved under pressure by the transfer ram into a die cavity. Pressures from the main ram and the transfer ram are maintained until proper curing is effected. Then both rams retract, causing mechanical knockouts to release the molded parts. 112

Automatic Positioning Table

The Fosdick Machine Tool Co., Cincinnati, Ohio, has announced a new automatic positioning table



Bliss hydraulic molding press for plastic parts



Fosdick automatic positioning table for radial drill

For more information on these products, use Inquiry Card, page 241

for use with radial drills. This table is designed for accurate reproduction of precision drilled, bored, tapped, and reamed parts without the use of jigs and without setting stop adjustments.

After two simple duplicating bars are prepared, positioning of the work is done automatically at the touch of a button and to accuracy limits of plus or minus 0.0001 inch. The two easily-made duplicating bars become permanent records of positions for particular jobs. They may be stored and used for repeat jobs at any later time. 113

Precision Surface Grinder

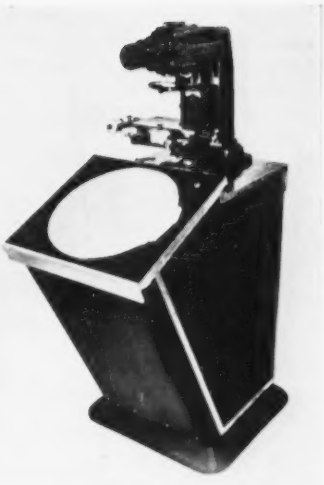
Rigidity and power for heavy cuts, combined with high sensitivity for precision finishing, are features claimed for the "Butterfly" precision surface grinder brought out by the Harvey Mfg. Corporation, a subsidiary of the Germanow-Simon Machine Co., Inc., Rochester, N. Y. This dual-purpose hand-fed bench type surface grinder can be used in the tool and die shop for many small jobs that would otherwise tie up larger machines.

Axial and radial rigidity of the spindle is obtained by mounting both ends in duplex super-precision angular-contact ball bearings. The spindle is dynamically balanced and powered by a 1/3-H.P., 3450-R.P.M. motor, rubber-cradled on a resilient base. The ways are ground and lapped for accurate movement, and handwheels are conveniently located. 114

Portman Optical Comparator

A Model R-300 optical comparator has been added to the line of comparators and projectors manufactured by the Portman Instrument Co., Inc., New Rochelle, N. Y. The multiple-phase optical system of the comparator projects an upright image. It gives the advantage of long focal length at every magnification, providing a large working space clearance between the lenses and the object stage platform.

An indexing type lens mounting capstan is also available, making it possible to change instantly from one magnification to another. Either a plain platform type stage or a universal coordinate measuring stage can be used with the instrument. The light source has a variable volume control, and is

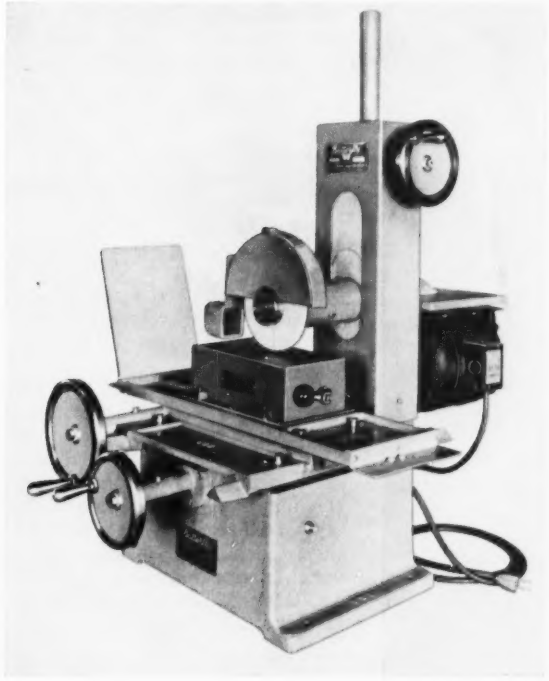


Optical comparator made by the Portman Instrument Co., Inc.

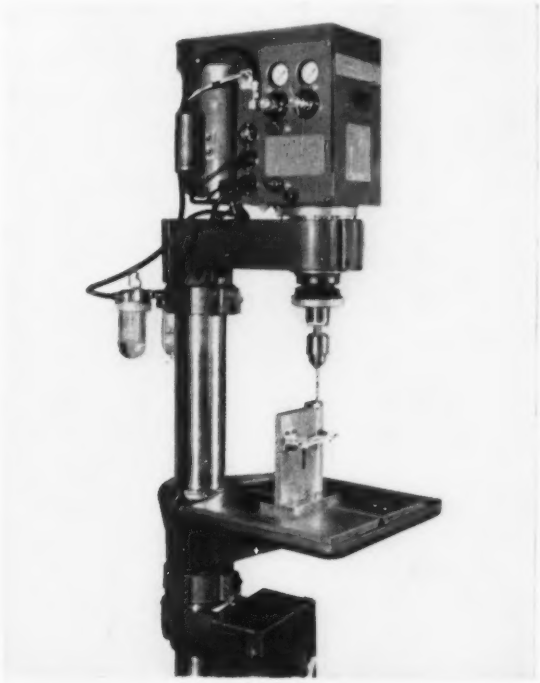
blower-cooled. The light housing is equipped to use a three-position turret-mounted color filter holder attachment. 115

Dumore Self-Contained Automatic Drill Unit

unit, designed to operate on a very low volume of air, has been announced by the Dumore Co., Racine, Wis. This Series 24 unit can



"Butterfly" surface grinder for tool and die shops, product of the Harvey Mfg. Corporation

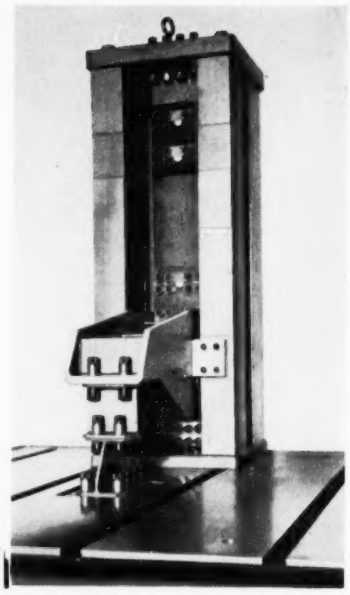


Dumore automatic drill unit with repeat cycle timer attachment for deep-hole drilling

be easily set up. It requires only two outside connections—conventional shop air and electric power—and can even be run on a small portable air compressor.

The unit is 8 3/4 inches wide, 15 inches deep, and has an over-all length of 23 1/2 inches including the chuck. It weighs 88 pounds. There are ten spindle speeds, ranging from 440 to 7400 R.P.M. The belt drive is designed to eliminate slippage and is available with either a 1/2- or 1/3-H.P. motor. The chuck capacity ranges from No. 60 to 3/8-inch drills.

The stroke of the unit can be synchronized with indexing fixtures or sequence operations through an auxiliary circuit built into the unit. The unit can be converted to perform such operations as tapping, reaming, deburring, centering, counterboring, spotfacing, countersinking, and hollow-milling. An electronic repeat cycle timer attachment is available for deep-hole drilling 116

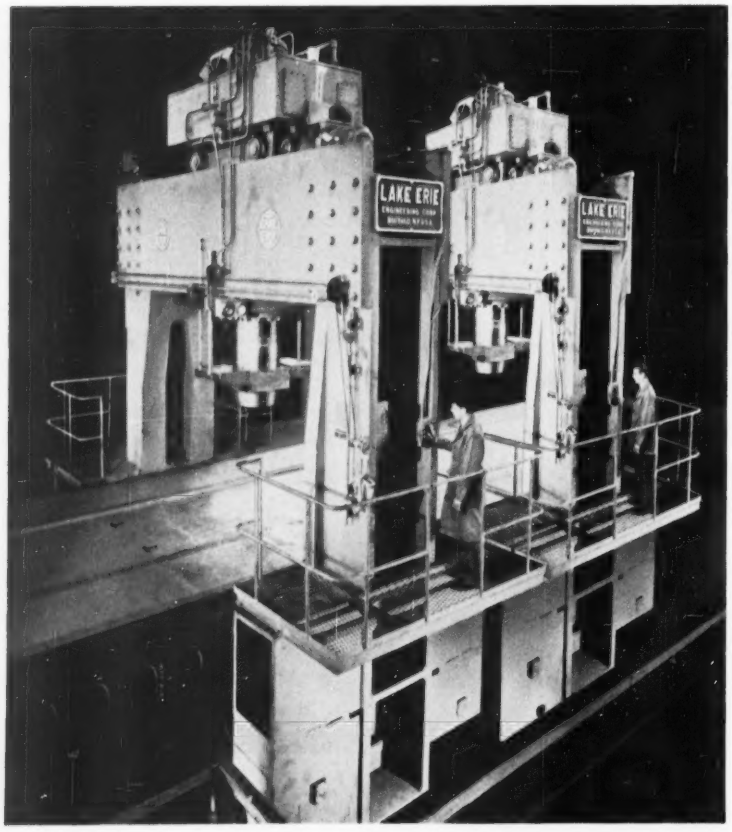


Sonntag fatigue testing fixture announced by the Baldwin-Lima-Hamilton Corporation

Lake Erie Twin-Carriage Traveling Head Press

A huge 2000-ton hydraulic press with a dual-carriage traveling head has been designed and built by the Lake Erie Engineering Corporation, Buffalo, N. Y., for one of the world's largest foundries. This press will be used to straighten castings measuring up to 22 by 10 feet and weighing over 46,000 pounds. The press is 40 feet long, 23 feet wide, 30 feet high, and weighs over 1,000,000 pounds. The bed is 12 feet 4 inches wide and 36 feet long, and has a large well that permits the handling of large castings in an edgewise position. As illustrated, four 9- by 5-foot filler blocks are slid into position to completely fill the well.

Each twin traveling head delivers 1000 tons pressure by means of a 5000-pound per square inch pump and a 50-H.P. motor. Individual carriages allow independent longitudinal movement and each traveling head can be transversely positioned to meet requirements. These operations are accomplished at traversing speeds of 120 inches per minute over an area of 267 square feet through power provided by separate gear-motors. 117



Lake Erie hydraulically operated twin-carriage traveling head press

Sonntag Fatigue Testing Fixture for Metals and Plastics

Fatigue tests under loads up to 50,000 pounds can be made on a 10,000-pound capacity fatigue testing machine equipped with a new Sonntag five-to-one multiplying fixture announced by the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. This fixture is especially suited for testing flat materials, including metals and plastics, as well as for joints that are riveted, welded, or bonded. By using adapters, round specimens, chains, belts, and other parts can be tested. Maximum deflection of specimens that can be readily tested on this new type of fixture is specified as plus or minus 0.050 inch.

The fixture has a 17 1/4-inch vertical space between the top of the loading member and the upper fixed platen, and a lateral space of 9 inches between the vertical columns. A lever principle is used in the fixture, a flex-plate acting as the fixed pivot of a 30-inch lever which is vibrated vertically by the oscillator of the fatigue testing machine. 118

For more information on these products, use Inquiry Card, page 241

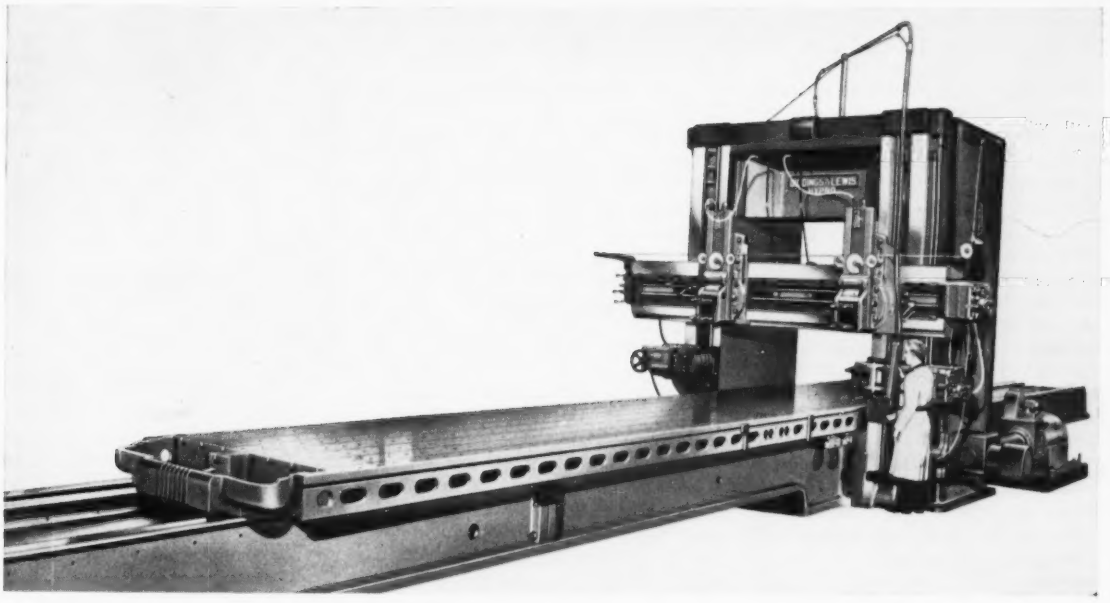


Fig. 1. Double-housing planer brought out by the Giddings & Lewis Machine Tool Co.

G & L Double-Housing Planer and Boring Machine

The Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., is planning to exhibit several new machines at the Fourth European Machine Tool Exposition in Milan, Italy, September 14 to 23. One of these machines, a Hypro double-housing planer, Fig. 1, has a width between housings of 49 1/2 inches, a height under the rail of 43 inches, and a table length of 22 feet. The maximum table speed of this machine is in excess of 300 feet per minute.

Features of the machine include renewable T-slot inserts; hydraulic table-stops and jacks; dual rail control; power cross-feed to side heads; centralized saddle control; an electric rail clamp; and precision adjustment handles.

The G & L "FUAR" 50 Series floor type horizontal boring, drilling, and milling machine equipped with an underarm, as shown in Fig. 2, will also be exhibited. Features of this machine include a main spindle with a diameter of 7 inches which has a longitudinal travel of 60 inches. There is also an auxiliary spindle 2.5 inches in diameter with longitudinal travel of 15 inches.

The spindle is rigidly supported for its full length of travel by the underarm. This equipment is used in conjunction with a continuous feed facing head, right-angle milling attachment, and faceplate driving attachment. A 2-ton crane provides an efficient means for quickly lifting and positioning the underarm attachments. 119

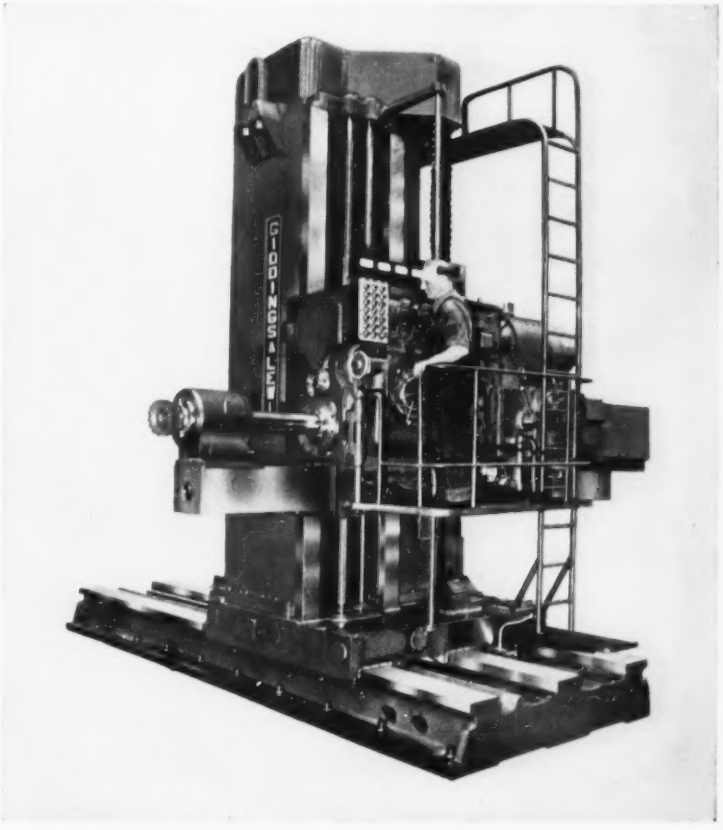


Fig. 2. G & L floor type horizontal boring, drilling, and milling machine

Ram Type Precision Milling Machine for Tool-Room and Production Work

A medium-size ram type milling machine for tool-room and production use is now being offered by the Fray Machine Tool Co., Burbank, Calif. This Model 1 1/2-V machine is built to take full advantage of high-speed steel cutters, while offering the rigidity and speeds necessary for carbide cutters. Two table sizes are available—9 by 36 inches with a longitudinal travel of 22 inches, and 9 by 42 inches with a longitudinal travel of 28 inches.

The machine is equipped with a Type 4 precision milling head, and a heavy-duty quill type attachment that is said to permit the operator to work to closer tolerances than has previously been possible. The quill has a travel of 3 1/2 inches. The standard head is equipped with a 3/4-H.P. motor, but either a 1- or 1 1/2-H.P. motor can be supplied.

The milling head has a wide range of speeds, the standard six-speed range being from 450 to 6400 R.P.M. An optional range with an eight-speed back-gear unit is from 150 to 6400 R.P.M. or sixteen-speed range from 75 to 6400 R.P.M.

A 12 1/2-inch standard, or a 20 1/2-inch optional, ram travel is available. A built-in work adapter is provided on the ram to facilitate positioning the head at the desired angle. 120

Bench Model Welding Positioner

A bench model welding positioner, available with hand or power table tilt, has just been introduced by the American Equipment Co., Paterson, N. J. This equipment is designed for maximum efficiency in positioning work for economical down-hand welding. It is designed for full-range positioning of the work, with reversible, variable-speed adjustment under full control of the welder.

The positioner is equipped with a gear type fluid drive motor which delivers smooth, positive hydraulic power. It operates on 110-volt, 60-cycle alternating current with a 1/3-H.P., 1750-R.P.M. motor. An infinite range of speeds is provided through one simple control with extra low "creeping speed" for certain welding operations. Work up to 100 pounds in weight is handled by the positioner, which has a full 135-degree vertical tilt—self-locking at any angle—and table rotation at any required speed. The machine weighs about 300 pounds, is 32 inches long, 28 inches wide, and 17 inches high. A floor stand is available. Larger heavy-duty sizes can be made to order. .. 121

V-Mill for Precision Milling, Boring, and Drilling

A Pierce-West V-mill adapted for a wide range of milling, boring, and drilling operations will be distributed by Lodding, Inc., Worcester, Mass. This machine has a precisely controlled, smooth-acting motion in three directions. There are graduations for angular settings and provisions for positive approach and locking actions.

The V-mill table is 14 by 36 inches and has a travel of 20 inches. Clearance between rods is 17 1/2 inches. The head has a 16-inch cross travel and a 17-inch vertical travel. Spindle travel is 4 inches and the distance from table to spindle ranges from 0 to 21 inches.

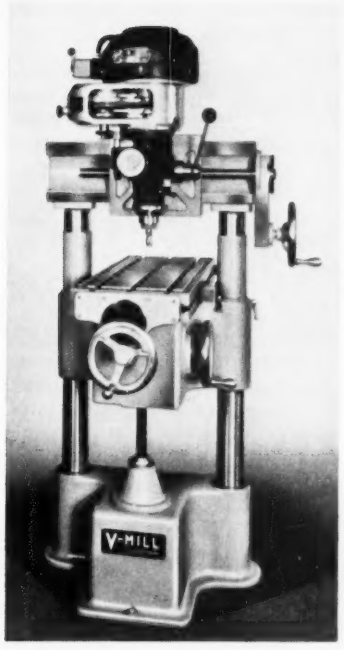


Precision milling machine built by Fray Machine Tool Co.



Welding positioner made by the American Equipment Co.

For more information on these products, use Inquiry Card, page 241



Pierce-West V-mill distributed by Lodding, Inc.

Eight speeds ranging from 120 to 3500 R.P.M. are available. An automatic collet closer permits fast tool changes without the use of wrenches. An enclosed micrometer depth stop is provided. Standard equipment includes a 1-H.P., three phase, 220- to 400-volt motor and four universal 20-degree collets ranging in size from 3/8 to 3/4 inch. 122

Andco Uni-Flux for All-Purpose Welding

An all-purpose welding and brazing flux called Andco Uni-Flux has been announced by Andco, Inc., Orchard Park, N. Y. Developed to provide one type flux for all types of gas welding and brazing, Uni-Flux can be used in place of a dozen or more fluxes. Aside from eliminating the necessity for carrying a large number of electrodes in stock, this also has the advantage of eliminating the possibility of using the wrong type of flux. Uni-Flux is said to permit welding through lead, beryllium, aluminum, bronze, galvanized surfaces, copper, rust, grease, paint, tar, and dirt. It can also be used to braze and weld cast iron, chromium and stainless steels, Monel, aluminum, bronze, silver solder, and many other metals. 123

Landis Improved Centerless Grinder

The Landis Tool Co., Waynesboro, Pa., has announced an improved design of its No. 12 centerless grinder. Changes have been made in this machine to facilitate the addition of automatic cycle and work-loading equipment while retaining many of the production and operating features of the previous model. Work-pieces up to 3 1/2 inches in diameter can be ground on the new machine, using standard work-rests. Heavy-duty work-rests increase the work capacity to 4 3/4 inches in diameter. Grinding wheels 20 inches in diameter and regulating wheels 12 inches in diameter and up to 8 inches wide are used. A 15-H.P. motor drives the grinding wheel.

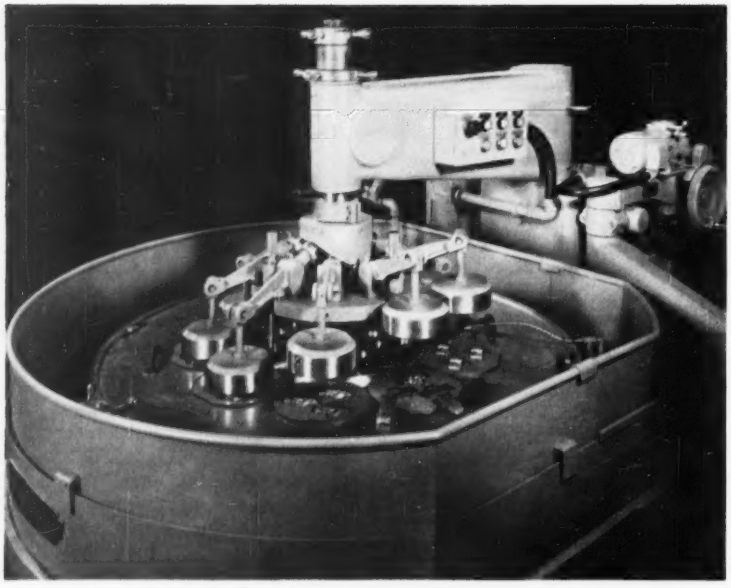
This grinder is adapted for either in-feed or through-feed grinding of many parts that can be more economically finished by centerless grinding than by center type grinding. It can be used for either heavy stock removal or extremely close tolerance work of straight or profiled shape. Built-in features facilitate rapid change of set-up, making small-lot production practical.

Improvements include pressure lubrication of the Microsphere spindle bearings of the grinding-wheel head. Pressure must be built up in the lubricating circuit before the wheel drive motor will start; if the pressure should fail, the drive motor will stop. Also available are hydraulic rapid in-feed and slow grinding feed. The rapid in-feed stroke is 1/4 inch and the continuous slow grinding feed is adjustable from 0 to 0.100 inch on the diameter. The rate of feed is also adjustable. This feed mechanism has been used in automatic cycles for continuous grinding of parts by the in-feed method.

A new hand-operated dresser for the regulating wheel is mounted on the wheel-head above the regulating wheel. The standard Landis regulating wheel dresser is also available on the machine. This equipment dresses the regulating wheel by moving the wheel past a stationary diamond. Traverse is by hydraulic power and is variable for any speed within its range. During the truing operation, the regulating wheel revolves at speed of 300 R.P.M. The work-rest is mounted directly on the bed casting between the grinding-wheel head and the regulating-wheel head. Both heads slide on ways and are positioned by hand-wheel feeds. A rheostat control provides for varying the speed of the regulating wheel. 124



Improved centerless grinder announced by the Landis Tool Co.



"Hyprolap" with semi-automatic feed announced by the Norton Co.

Norton Flat Lapping Machine

A single-face, flat lapping machine with semi-automatic feed, known as the No. 36-F "Hyprolap," has been announced by the Norton Co., Worcester, Mass. This machine has been designed for higher production than could be obtained with former machines by making provisions for continual lapping and the complete lapping of the work in a single pass around the lap. Lapping in a single pass is said to be possible because of the greater efficiency of the bonded abrasive laps.

Cleaner work-piece surfaces, free of grit either imbedded or trapped in pores and crevices of the work, are another advantage claimed for the bonded abrasive laps. Grit is washed away by a stream of filtered coolant on the lap. This feature results in a saving of time because parts can be accurately lapped without the necessity of stopping the operation to clean the laps.

Lapping is interrupted only to true the bonded abrasive lap. Truing is done by a diamond held in a variable-speed, power-operated truing arm. The lap can be trued without removing the work-holder. In addition, the truing speed of the device is quickly adjusted.

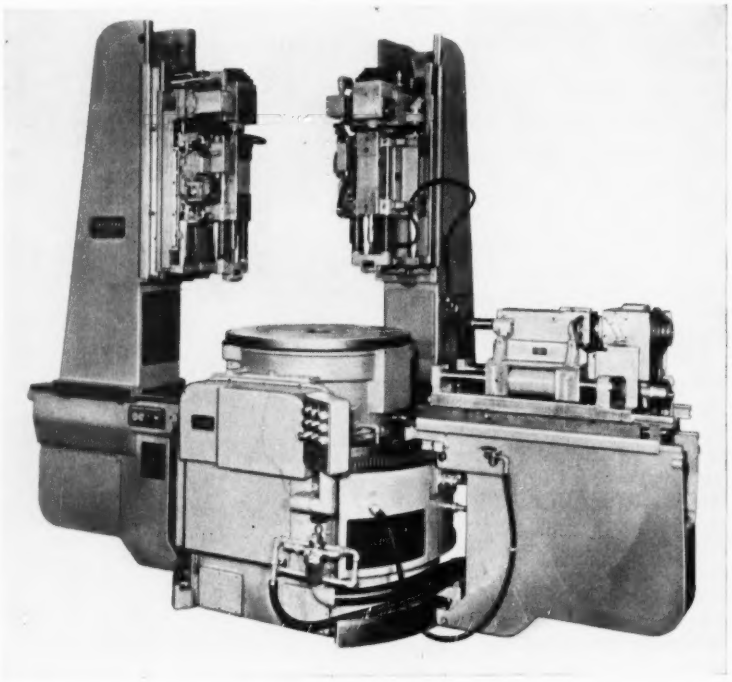
Weight is automatically applied to the parts grouped in each work-holder so as to secure the desired lapping action. The weights are lifted clear as they pass through the loading station, to permit loading and unloading of the work pieces. The weights are then applied to the newly loaded pieces as they are moved out of the loading area. The machine can be arranged for fully automatic continuous feed operation. 125

Hartford Special Universal Drilling Machine

The Hartford Special Machinery Co., Hartford, Conn., is now offering a versatile universal drilling machine which can be readily turned into a special single-purpose machine to suit specific requirements. This standardized basic machine has been designed to provide the accuracy required for the manufacture of precision aircraft parts or heavy work.

The machine is fully automatic in operation and accommodates up to four drilling or tapping units, all of which are quickly adjustable radially, vertically, and circumferentially. Easily changeable cams permit quick conversion to meet engineering changes on work-pieces.

The air-hydraulic heads of this machine will drill up to 3/4-inch holes in mild steel and 1/2-inch holes in stainless steel. Interchangeable index-plates are available for different hole patterns. Spindle speeds range from 180 to 6700 R.P.M. and the feed range is from 1/2 inch to 40 inches per minute. Adjustments can be made quickly for standard 96-notch and other index-plates or for intermittent and irregular spacing. Special indexing set-ups are available in as many variations as



Hartford versatile universal drilling machine

For more information on these products, use Inquiry Card, page 241

192 indexes. The capacity of the machine ranges from work 30 to 87 inches in diameter with bolt circle diameters of 8 to 65 inches. The machine weighs approximately 17,800 pounds. 126

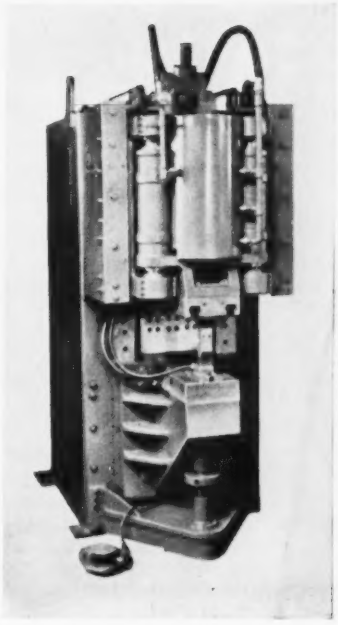
Niagara Press Brakes Adapted for Wide Range of Metal-Forming Operations

A newly designed line of press brakes has been introduced by the Niagara Machine & Tool Works, Buffalo, N. Y. The machines are said to have exceptional capacities for performing forming, bending, punching, blanking, and related operations.

Uniform bends with straight-edge accuracy are assured by double-end twin drives with double-reduction gearing to provide uniform, constant application of power. Rugged and streamlined frames feature box type crowns that give maximum resistance to deflection and assure permanent alignment of bearings and ram. Laminated non-metallic ways serve to reduce wear to a minimum. All gearing is totally enclosed in sealed oil baths. An extensive line of Niagara press brake dies is available for use with each of the models in the complete 50- to 775-ton range of press brakes. 127

High-Pressure Projection Welder with Ram of Special Design

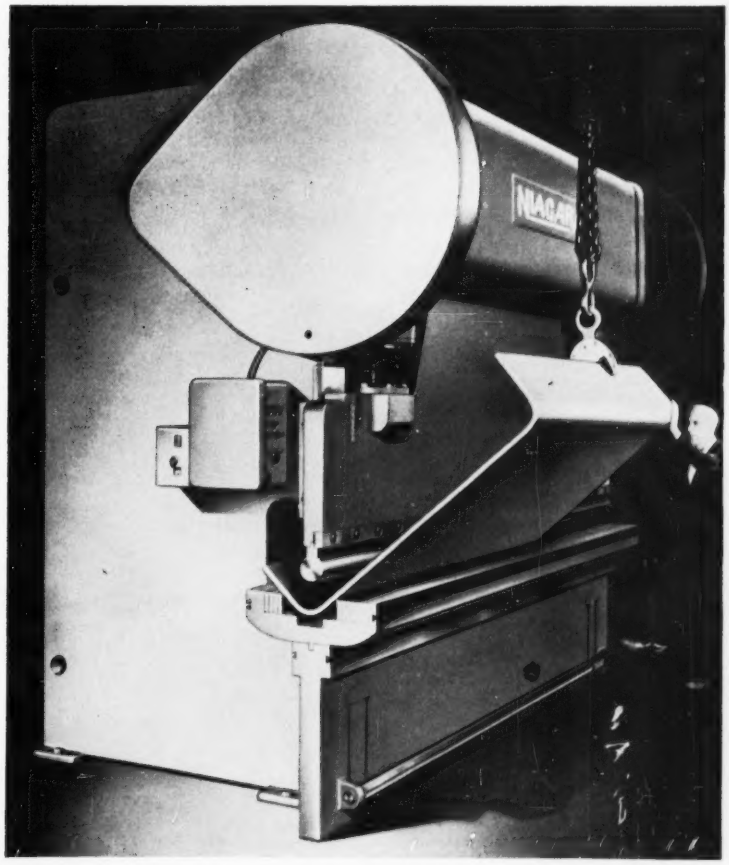
A projection welder that combines high welding pressure with fast ram action is announced by the Universal Welder Corporation, Cleveland, Ohio. This welder is particularly suited to the welding of light metals and other applications requiring high pressures and quick follow-up. It is made in capacity ratings of from 5000 to 18,000 pounds per square inch over a size range of from 250 to 500 kilovolt-amperes.



Projection welder brought out by the Universal Welder Corporation

The welding stroke range is from 1/2 inch to 2 inches. An adjustable retraction-stroke ram, however, provides an additional travel of 3 to 6 inches. This is obtained by an air cylinder acting through toggle linkage and is counterbalanced for a smooth, shockless stroke.

The new welders are available with standard throat depths that vary in steps of 6 inches from 12 to 48 inches. The adjustable lower knee may be of the double-screw, knee-braced type, or equipped with a hydraulic jack. 128

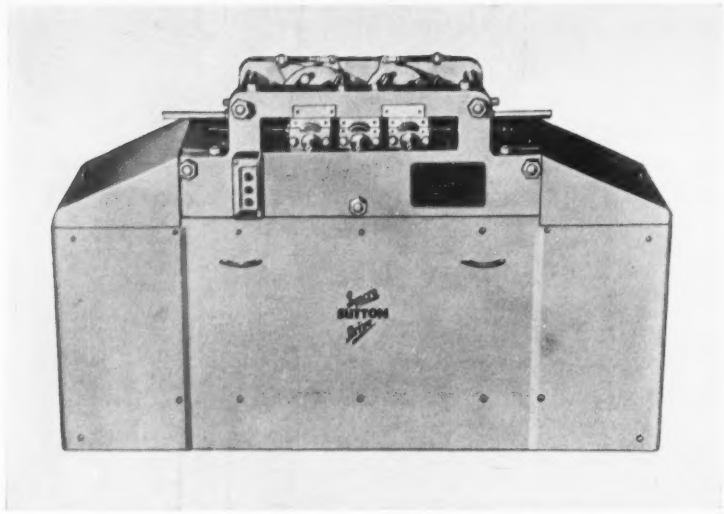


Press brake of new line placed on the market by the Niagara Machine & Tool Works

Over-Running, Indexing and Backstopping Clutches

A new series of large-bore clutches for over-running, indexing, and backstopping is announced by the Formsprag Co., Van Dyke, Mich. Applications requiring large-bore sizes, up to 12 inches, can now have the performance features of the Sprag principle incorporated in the company's regular clutches.

The clutches are said to provide maximum torque capacity for size and weight and instantaneous engagement without head-shaft wind-up. They will be constructed with ball bearings to insure smooth operation. 129



Sutton straightening machine for small tubes and bars

Sutton Straightening Machine

A table-high, small-diameter Syncro-Drive tube and bar straightener has been introduced by the Sutton Engineering Co., Dept. M, Bellefonte, Pa. The work is passed between two large rolls which are opposed by three smaller pressure-adjusting rolls. All five rolls are motor-driven and the machine operates without guides. Center distances between rolls, as well as roll angularity, are adjustable. The machine is equipped with a 2-H.P. variable-speed drive, and is designed for operation at speeds ranging from 60 to 300 feet per minute. . . 130

Simplex Precision Boring Machine with Mechanical Automatic Feed

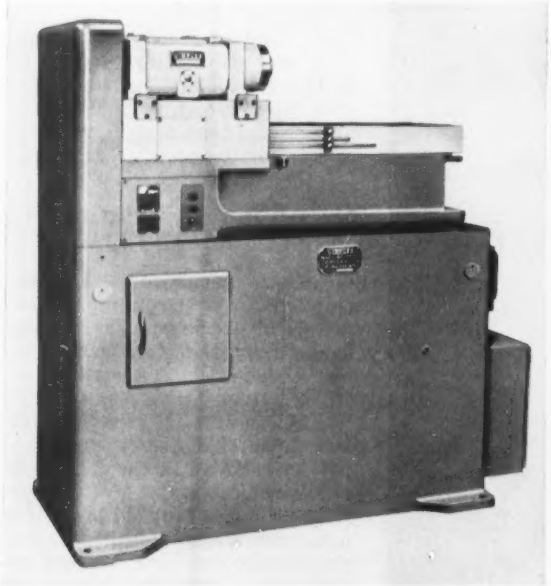
A precision boring machine with mechanical automatic feed adapted for small or medium-size jobs has been built by Simplex Machine Tool Corporation, Milwaukee, Wis. The feed unit gives a complete automatic cycle consisting of rapid traverse, feed, dwell, and rapid return. After the start-button is initially pressed, the cycle is controlled by means of limit switches.

The total length of feed and of rapid traverse is adjustable by means of trip-dogs. At any time during the cycle, the stop-button can be pressed to halt the machine, and an emergency return is also provided to allow the table to be returned. Feeds from 1 1/2 to 13 1/2 inches per minute are available through change-gears. A reversing feed can also be supplied if desired. 131

Brown & Sharpe Electronic Micrometer

An electronic micrometer that measures small parts to 0.00001 inch at a magnification of 18,000 times has been announced by the Brown & Sharpe Mfg. Co., Providence, R. I. With this equipment the magnification is continuously variable from 1800 to 18,000 times.

The electronic amplifier and gage-head cartridge combined with a standard indicating bench micrometer to produce the electronic micrometer are all Brown & Sharpe standard precision instruments. A frictionless member supported by parallel reeds transmits motion from the anvil to the gage-head cartridge, and the micrometer head is set to the required

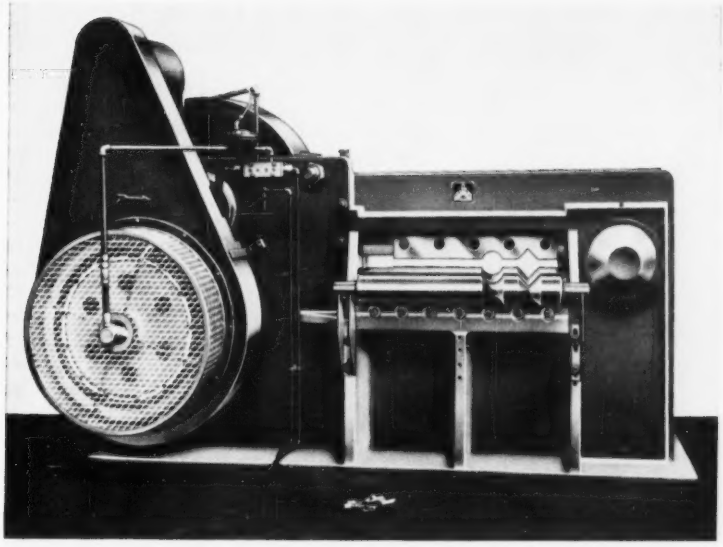


Boring machine placed on the market by the Simplex Machine Tool Corporation



Electronic micrometer announced by the Brown & Sharpe Mfg. Co. for measuring small parts

For more information on these products, use Inquiry Card, page 241



Billet shear produced by the Canton Division of the Hill Acme Co.

0.0001 inch. When the instrument is used for extremely fine measurements, its setting should be made to Johansson gage-blocks or other precision gages.

An easily operated retracting lever provides for the rapid placing of work between the measuring points. The micrometer screw is readily clamped in position, and a small table of adjustable height is provided on which to rest the part being measured. Measuring pressure is adjustable from 3 ounces to 2 1/2 pounds when used at a sensitivity of 0.0001 inch, making it possible to use the proper pressure. The measuring instrument is particularly adapted for measuring fine magnet wire, small screw machine parts, pivots, and similar work. 132

Rust Veto Spray Dispenser

Pressurized 12-ounce push-button cans containing Rust Veto Spray, announced by E. F. Houghton & Co., Philadelphia, Pa., provide a quick, clean, and effective means for applying a thin, transparent protective film to metal parts. These dispensers are most useful in protecting small tools, dies, gages, and precision parts from rust during storage. Coatings need not be removed. . . . 133

Canton Billet Shear

The Hill Acme Co., Cleveland, Ohio, has announced a Canton billet shear of totally different design from those now in use for the production cutting of metals in rounds, squares, flats, angles, channels, I-beams, and special shapes. It is designed so that the heavy cutting will be done near the fulcrum point of the lever arm with a mechanical advantage of approximately five to one.

Knives up to 36 inches in length can be mounted on the billet shear. This extra knife length provides for greater versatility in the types of material cut. In shops where high production of one size of material is common, the use of short blades, approximately 10 1/2 inches long, with the proper type and size of groove, permits economical blade use and quick changing of cutters.

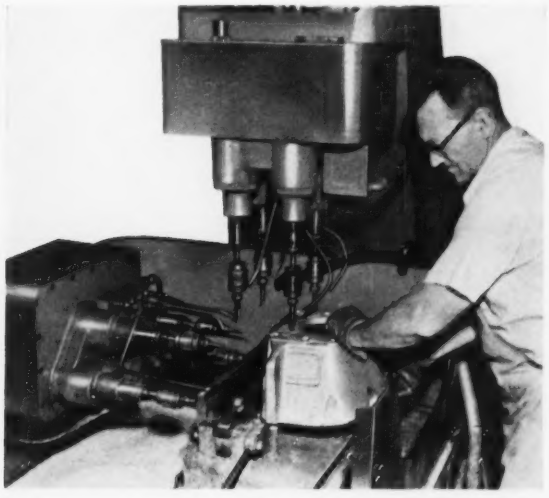
The shear has a lever arm of cast steel and a bed of heavy welded-steel plate. A minimum of moving parts insures low maintenance costs. One of the outstanding features is the Canton patented knife seat construction which permits the quick, accurate setting of the blades without the necessity of shimming. 134

Special Machine Equipped for No-Breakage Tapping

A two-way tapping machine manufactured by the Buhr Machine Tool Co., Ann Arbor, Mich., and equipped with a new type of



Push-button dispenser brought out by E. F. Houghton & Co. to facilitate application of its Rust Veto Spray



Special Buhr machine equipped with "Safe-Torque" releasing tap drivers manufactured by Scully-Jones & Co.

adjustable "Safe-Torque" releasing driver made by Scully-Jones & Co., Chicago, Ill., is said to have virtually eliminated tap breakage. The special machine is designed for tapping four 5/16–18 and four 7/16–14 Class 2 holes in die-cast aluminum transmission cases. Two features of the driver are said to be responsible for its ability to protect taps against breakage normally caused by hard spots, inadequate cooling or lubrication, dull taps, improper sharpening, and other adverse machining conditions. One feature is a spring-loaded centering plug which absorbs shocks when bottoming in blind holes. The cushioning stop and instantaneous release of the driver permit bottom-tapping at full speed to full depth without breakage. The other feature is an over-running roller drive, which releases completely when the torque approaches the strength limits of the tap. In releasing, the outside member of the driver revolves around the inner drive-collet member on anti-friction ball bearings, thus eliminating friction, heat, and wear. . 135

Michigan "Shear-Speed" Gear Shaper

The "Shear-Speed" line of gear shapers built by the Michigan Tool Co., Detroit, Mich., is being expanded by the addition of a heavy-duty Model 18105-HD machine especially designed for cutting the teeth on large coarse-pitch gears. This shaper simultaneously cuts all the teeth in a gear, special cam, ratchet, and other special forms by reciprocating the blank through the cutting head and infeeding the form-cutting tools.

Gear teeth up to 3 diametral pitch can be cut. The particular gear being cut on the machine shown has a diametral pitch of 3 1/2 and outside diameter of 10 inches. This heavy-duty gear has thirty-two teeth and a face width of 1 7/8 inches. The teeth are produced with pre-shave forms. The high rigidity and strength of this machine absorb the heavy loads imposed in cutting the thirty-two coarse-pitch teeth at one time.

Feed, relief, and tool sharpening compensation adjustment controls are located on the vertical center line of the head and cutting tools, permitting the entire head assembly to be contained in a compact and rigid housing. The machine will cut gears having face widths up to 4 1/2 inches. It has a 5-inch stroke and will shape gears with diameters ranging from 5 to 10 inches. 136

Black & Decker Heavy-Duty Sander-Grinder

A 7-inch heavy-duty sander-grinder designed for continuous production service has been put on the market by the Black & Decker Mfg. Co., Towson, Md. This tool will handle a wide range of surfacing operations, using abrasive discs, wheels, and other available accessories. Features include a B&D universal motor having 90 per cent more power than the one used in the previous 7-inch heavy-duty sander. Despite this, the new tool is lighter, weighing only 14 pounds.

The sander-grinder is available with a no-load spindle speed of either 5200 or 6000 R.P.M. Lubricant-sealed ball bearings are used throughout and heat-treated spiral bevel gears provide an even flow of power. A replaceable steel wear ring protects the front of the main housing from wear. Brush and commutator inspection is simplified by a removable inspection plate.

The sander-grinder can be used with an optional line current of 115 or 220 volts, and one on order can be had for operation on either 125 or 240 volts. The tool may be suspended from a balance reel, an eyebolt being provided for this purpose. 137

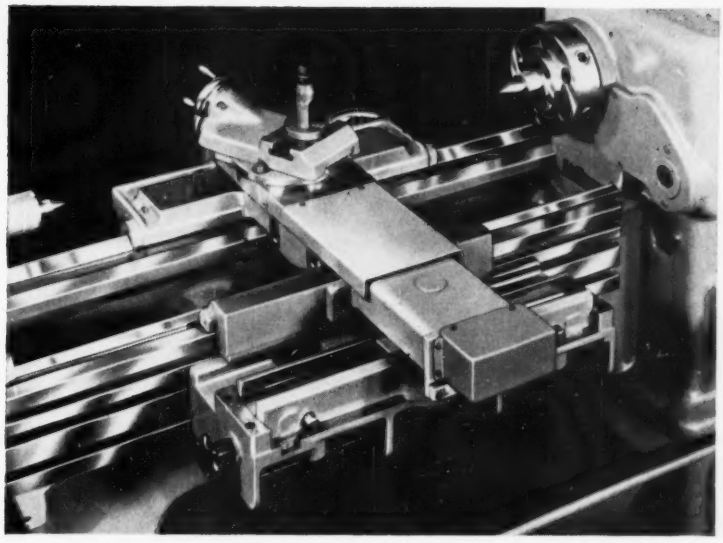


"Shear-Speed" gear shaper for coarse-pitch gears announced by the Michigan Tool Co.



Heavy-duty sander-grinder of improved design made by the Black & Decker Mfg. Co.

For more information on these products, use Inquiry Card, page 241



P & W Model "C" lathe equipped with improved taper attachment

Pratt & Whitney Taper Attachment for Lathe

An improved taper attachment is being marketed by Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn., for its Model "C" precision toolroom lathes. This attachment can be used to turn tapers having an included angle of 20 degrees (4-inch taper per foot) and 15 inches in length on the 12-inch lathe or 18 inches on the 16-inch lathe.

Preloaded balls riding on bearing surfaces eliminate longitudinal play. Two of the four bearings in the taper-bar shoe are mounted on eccentric studs, thus allowing adjustment and preventing transverse play. The taper-bar itself is securely bolted to the lathe bed by means of four T-bolts.

With this attachment, a straight cut can be interspaced between taper cuts without changing the taper-bar setting. All bearing surfaces, including the taper-bar ways and the cross-feed screw, are hardened and ground to obtain smooth operation and longer life. The attachment is protected with wipers and guards to prevent dirt from entering mechanism. . . 138

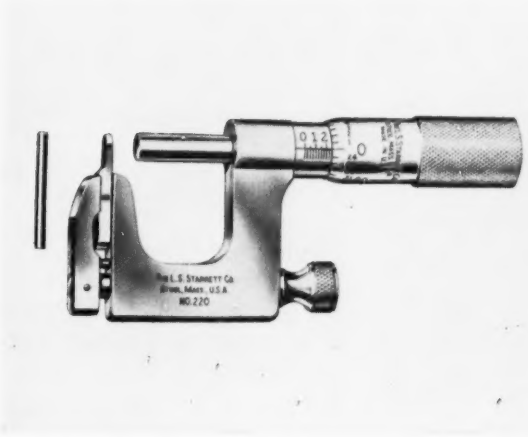
Starrett Micrometer with Interchangeable Anvils

A No. 220 Mul-T-Anvil micrometer with a measuring range of from 0 to 1 inch, reading in increments of 0.001 inch, has been placed on the market by the L. S. Starrett Co., Athol, Mass. This micrometer is designed to permit quick, accurate measurement of tubing, cylindrical walls, and distances from holes or slots to an edge of the work. The instrument is also handy for measurement in hard-to-reach locations. It can be used with standard or special anvils and the anvils can be changed quickly and locked rigidly by a simple lock-screw adjustment.

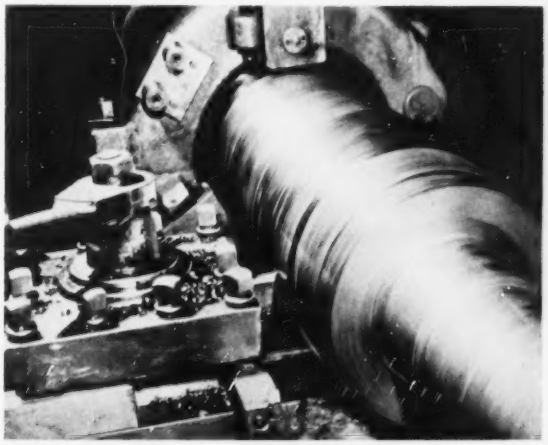
Two anvils are furnished: a rod anvil approximately 0.120 inch in diameter; and a flat anvil 0.125 and 0.060 inch thick at opposite ends. The first is useful for measuring from a hole to an edge of the work. With the second, distances from the inside of slots and grooves to an edge can be conveniently measured. Other anvils can be made by the user. 139

Wear-Resistant Steel-Cutting Cemented Carbide

A new medium-duty, high wear-resistant steel-cutting grade cemented carbide for light roughing and general finishing, which is claimed to provide up to 30 per cent better performance than existing carbides in its machining range or area, has been introduced by the Carboloy Department of General Electric Co., Detroit, Mich. Especially developed for faster machining speeds, this Carboloy Grade 350 cemented carbide is considerably tougher than present wear-resistant carbides. It extends the machining range of the new 300 Series to another area—to withstand cutting temperatures as high as 1800 degrees F.

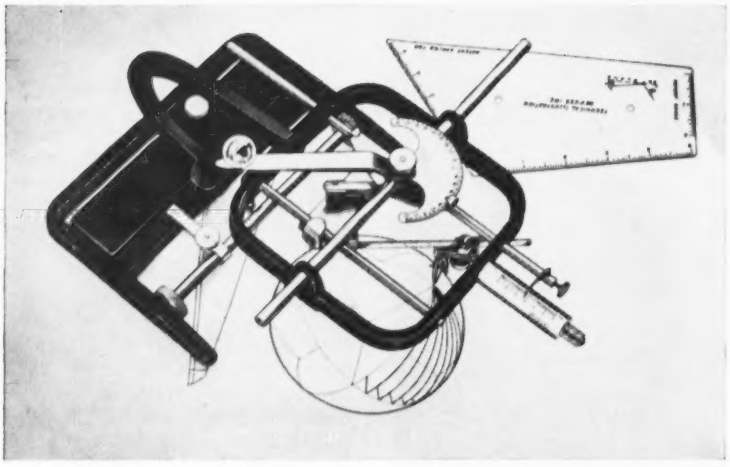


Mul-T-Anvil micrometer designed to meet diverse measuring requirements marketed by L. S. Starrett Co.



Carboloy Grade 350 carbide tool cutting a hot-rolled steel shaft of 228 Brinell hardness

For more information on these products, use Inquiry Card, page 241



Circular drawing machine introduced by Charles Bruning Co., Inc.

Use of this Grade 350 cemented carbide on the huge motor shaft shown in the illustration in the plant of an eastern motor builder increased by about 30 per cent the number of linear inches of metal cut as compared with the previous carbide used. The shaft is AISI 1045 hot-rolled steel of 228 Brinell hardness. Work was done on a 40-H.P. lathe at a speed of 300 surface feet per minute, with cut depth varying from 1/16 to 1/8 inch and a 0.020-inch feed. .. 140

"Oilgearducer" Variable-Speed Drive

The Oilgear Co., Milwaukee, Wis., has announced that its new Type "H" fluid power, constant displacement, axial-piston motors have been combined with Falk concentric and right-angle all-steel reducers to form a new line of integral "Oilgearducers." These compact variable-speed units have motors of 1, 3, 8, 12, and 20 H.P. Flanged and resilient couplings connect them to single, double, triple, and quadruple reducers with ratio combinations providing maximum output speeds from 1.7 to 1170 R.P.M. Normally continuous operation output torques ranging from 42 to 41,500 pound-inches are based on a pressure of 1100 pounds per square inch. Starting and peak torques for intermittent service can be up to 60 per cent higher.

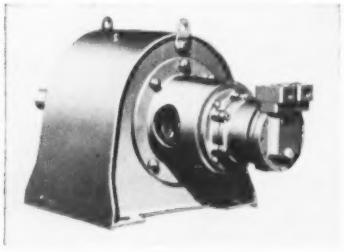


Fig. 1. "Oilgearducer" of 20-H.P. rating for speeds up to 28 R.P.M.

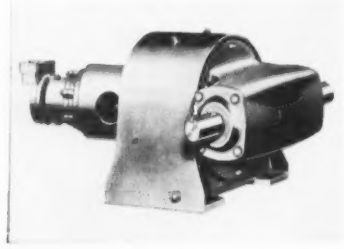


Fig. 2. "Oilgearducer" with double right-angle output shaft reducer

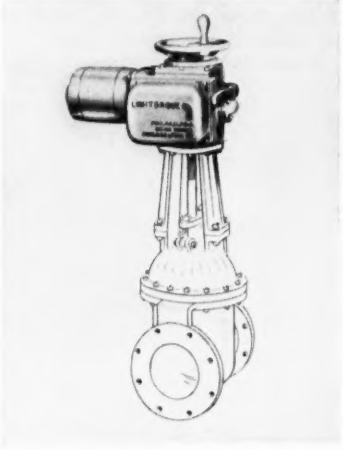
Similar concentric Oilgearducers with improved oil-tight shaft seals for vertical wall mounting and with flanges for floor mounting are also available for vertical shaft applications. Types with single or double right-angle output shafts are available in ratios from 5 to 1 up to 1500 to 1.

In combination with variable-delivery pumps (input units), Oilgearducers provide accurate speed regulation over the entire range; an infinite speed range (stepless); cushioned and controlled acceleration and deceleration; quick reversal; constant torque over entire range; hydrodynamic braking; continuous service on reversing, starting, stopping, and speed change applications. 141

Bruning Circular Drawing Machine

A drawing machine introduced by Charles Bruning Co., Chicago 41, Ill., enables technical illustrators and draftsmen to make accurate pictorial drawings in less time than it takes to make plan-view drawings. Two simple settings—one to establish the major diameter, the other the minor diameter—enable the user to draw mathematically precise ellipses in any ratio by degrees or from points on a drawing. Repeated and related ellipses on the same axis are obtained through the rolling parallel action of the machine—a valuable feature in making exploded views.

A five-piece template set, also being marketed, provides a uniform, positive system for determining dimensions of lines and angles in pictorial drawing without requiring involved projections, mathematical calculations, graphs, or special boards. The templates enable draftsmen to draw views of an object from any angle with exact, proportionately correct dimensions in a fraction of the time it takes to make a plan-view drawing. 142



"LimiTorque" valve control made by Philadelphia Gear Works

Motorized "LimiTorque" Valve Controls

A line of SMA-00 and SMA-000 "LimiTorque" valve controls is being manufactured by the Philadelphia Gear Works, Philadelphia, Pa., to meet the need for motorized operation of small valves ranging from 1 1/2 to 8 inches in diameter. These valve-operating

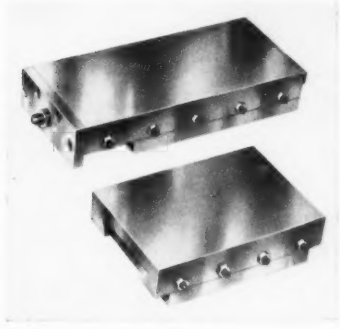
For more information on these products, use Inquiry Card, page 241

devices may be controlled electrically from a push-button station. In case of power failure, a handwheel incorporated in the control unit can be used for manual operation.

As the name implies, "Limi-Torque" limits the amount of torque applied to the valve-operating parts. Also, the amount of torque or stem thrust may be accurately adjusted for varying service conditions through a micrometer type torque switch. The controls are available for motorizing gate, plug, and butterfly valves. 143

Slide Assemblies Developed to Facilitate Manufacture of Special Machines

Standard slide assemblies that can be used to speed the design and manufacture of special production machines are being offered by Russell T. Gilman, Inc., Milwaukee, Wis. A selection of fifty-two varied types and sizes is available. The size range runs from 2 to 6 inches in width, with lengths from 3 to 16 inches. These slides move on dovetail ways and are precision made to assure smooth operation.



Gilman standard slides for use in building special machines

Basic slides include only the male and female members, gib, and gib adjusting screws. Assembled slides are made with heat-treated, compression type return springs, mounted on guide pins in an end plate and fitting into drilled holes in the male member. An adjustable stop-screw is also provided for regulating the length of travel of the slide. An oil-resistant Neoprene shield protects sliding surfaces from dirt, chips and abrasive material. 144

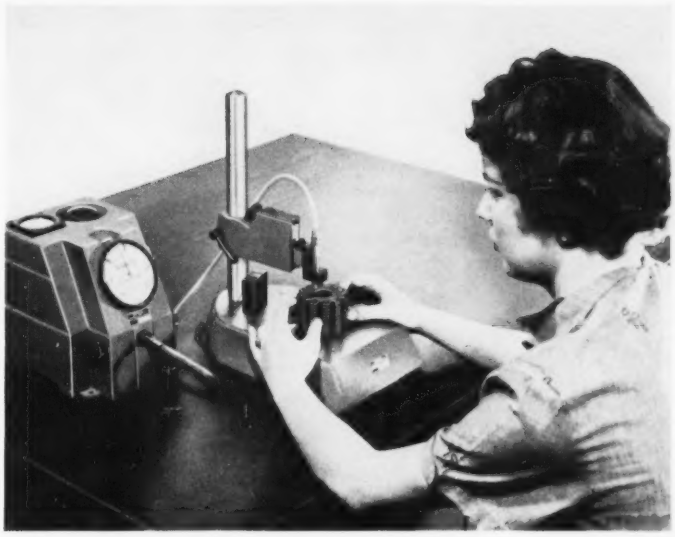


Fig. 1. Federal "AirProbe" being used with Dimensionair air gage

Federal Gaging Equipment

A universal gage-head called the "AirProbe," for use with its Dimensionair air gage, has been introduced by the Federal Products Corporation, Providence, R. I. The AirProbe, shown in use in Fig. 1, can be mounted on a variety of fixtures, making it possible to check either single or multiple dimensions of almost any type. It can also be applied to the regular Federal gages, thus eliminating the necessity of designing special gages.

The spindle-like AirProbe, no larger than a cigarette, is accurately calibrated and requires no tolerance setting masters. It is set to zero on the accurately graduated scale of the Dimensionair and then adjusted in the gage in the same way as a dial indicator. All readings are actual calibrated measurements, not arbitrary values between minimum and maximum limits. This is especially valuable in determining dimensional variations for rework.

A new Federal indicating snap gage, Fig. 2, built especially for measuring crankshafts or similar work where projections of the work-piece require a longer reach than usual, has also been announced. This Model 1340 P-40 gage is made thin so that it can be inserted between the shoulders and right up to the sides of the crankshaft bearings. The gage can be made to any single dimension between 1.875 and 3.000 inches.

A new method of inspecting pitch diameters of spur gears, helical gears, splines, and chain sprockets is made possible by the gear gage shown in Fig. 3, which was recently developed by the concern. Cylindrical gaging contacts are used on this gage. The upper contact is free to swivel while it is being adjusted to the master. When this contact is seated properly in relation to the lower con-

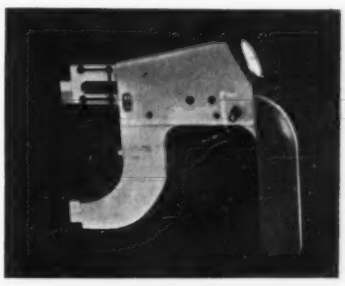


Fig. 2. Indicating snap gage for checking crankshafts, announced by Federal Products Corporation



Fig. 3. Federal gage for checking pitch diameters of gears

tact, it is locked in position. This arrangement is said to provide more stability than it is possible to obtain with floating contacts.

An adjustable rear guide helps to locate the gage in the proper spaces between the gear teeth. Pitch diameters of gears having teeth of either even or uneven number can be inspected. There are five sizes in the regular series of these gages, each of which has 1 inch of adjustment. 145

Besly Vertical-Spindle Spring Grinder

A new vertical-spindle spring grinder, announced by the Besly-Welles Corporation, Beloit, Wis., is said to improve the grinding quality and considerably reduce abrasive disc wear in processing automotive direct-action type shock absorbers. These springs have an inside diameter of 0.586 inch and the wire size varies from 0.080 to 0.105 inch. The ends are ground parallel over a clean-up area of 320 degrees and must be square with the axis of the spring within 1/2 degree. Production is about 1920 springs per hour.

The grinding is done dry with the entire cycle automatically controlled. In operation, springs are loaded into the slowly rotating feed-wheel until all stations are filled, after which the cycle start button is pressed. The feed-wheel then goes into fast rotation and the upper grinding head rapidly traverses to the work. The cycle progresses into a controlled feed and spark-out period where final size and squareness are imparted to the springs. At the completion of the spark-out period, the grinding head rises and the feed-wheel decelerates. 146



Red Ring automatic gear gaging and sorting machine

Motorized Gear-Gaging and Sorting Machine

A fully automatic gear gaging and sorting machine is the first in a new line of Red Ring gear inspection units announced by the National Broach & Machine Co., Detroit, Mich. This machine can make up to four checks on gears for both size and helix angle accuracy. When used to inspect spur or helical gears before shaving operations, the machine can be adapted to check size only. When employed to check helical gears following gear-shaving operations, the combination size and helix angle check is made.

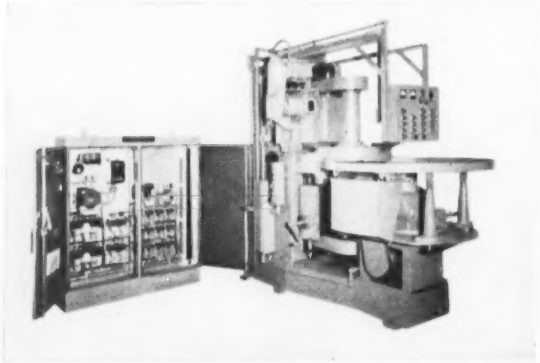
The machine illustrated can be installed in an automated line for gaging gears either before or after shaving in conjunction with chutes, Syntron units, or other types of feeding devices. It can also be provided with a magazine feed and utilized as a separate gaging device. Built-in controls are included in the machine to shut off the shaving machine after a predetermined number of rejected gears are produced. These controls can be adapted to shut off the machine on the basis of a percentage quantity of rejected parts or after a certain number of successive rejects of a given type have been produced.

Gears that meet inspection requirements are directed through a chute in the base of the machine. Under-size gears are directed to another feed chute. Those that are over-size and have errors in helix angle are directed through still another feed chute. Signal lights on a control panel at the front of the machine indicate what caused the gaging machine to shut down the shaving machine.

The checking machine illustrated automatically inspects a shaved eighteen-tooth, 16-diametral pitch, 20-degree pressure angle pinion having a pitch diameter of 1.1691 inches, a helix angle of 16 degrees, and a width of 2 1/2 inches. This pinion is used in an automotive automatic transmission. The compact gaging unit is approximately 24 inches long, 20 inches wide, and 14 inches in height. 147

Inspection Light

An inspection light with mirror and plastic probe which facilitates directing light to the exact spot desired is available through the Moore Mfg. Co., Swedesboro, N. J. When the probe is inserted in a bore or dark area, the light is beamed to the probe which gives a flood of light at the tip end. The mirror on the probe provides a powerful illuminated reflection for the inspection of wiring or close machine areas. With the mirror and probe removed, the handle serves as an insulated-top flashlight. 148



Automatically controlled spring grinder brought out by the Besly-Welles Corporation



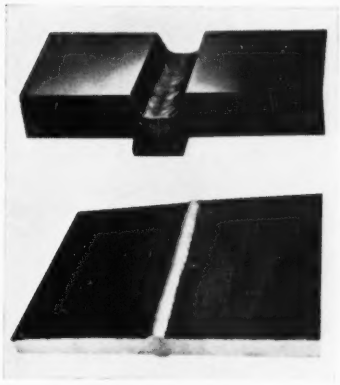
Inspection light with mirror and plastic probe made by the Moore Mfg. Co.

For more information on these products, use Inquiry Card, page 241

"Jetweld 2" Electrode with Coating Containing Powdered Metal

The second electrode in the newly developed line of electrodes with powdered metal in their coatings, brought out by the Lincoln Electric Co., Cleveland, Ohio, has been designated the "Jetweld 2." This electrode is designed especially for welding butt and deep-groove joints.

The powdered metal in the coating provides an additional source of metal, and the excess heat available in the arc is used to melt this metal. Faster speeds are therefore possible without too much penetration, gouging of the parent metal, under-cutting, spatter, overheating of the electrode coating, or other difficulties associated with high-current production welding.



Examples of welding done with new "Jetweld 2" Electrode developed by the Lincoln Electric Co.

The electrode operates on either alternating or direct current, but alternating is preferred. Typical physical properties are: yield point, 55,000 pounds per square inch; tensile strength, 66,000 pounds per square inch; and elongation as welded, 28 per cent and as stress-relieved, over 30 per cent. The electrode meets all E-60 classifications in the downhand position and is available in diameters of 5/32, 3/16, 7/32, and 1/4 inch. 149

Special Atmosphere Testing Unit

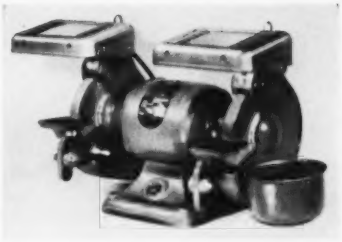
The Electric Furnace Co., Salem, Ohio, has brought out a portable unit for testing gases in research and production departments using special atmospheres or heat-treating furnaces. The quality of a generated gas or of the atmosphere of a furnace is quickly determined with the tester. It can also be used to detect the presence of sulphur, which usually is detrimental to bright annealing treatments.

To perform a test, the inspector clamps a strip of metal, like the one being heat-treated, between two electrodes visible within a Pyrex tube. Thus, the material becomes a resistor in a circuit. The



Unit for testing heat-treating atmospheres brought out by the Electric Furnace Co.

gas atmosphere to be tested is then introduced into the tube. The inspector raises the temperature of the specimen to that of the material in the furnace, holds the sample at the temperature for the desired time, then drops the atmosphere to the critical temperature at which the material will discolor in the gas atmosphere being tested. This establishes the length of time the material must pass through the critical range in the available atmosphere to prevent discoloration. 150



Improved Delta-Rockwell grinding and buffing machine

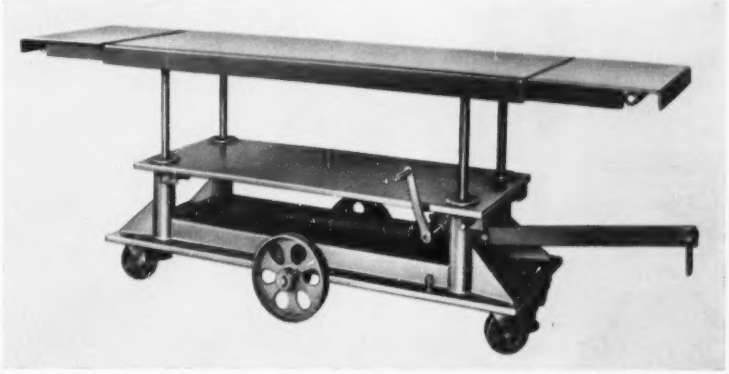
Improved Grinding and Buffing Machines

Basic improvements in all single- and three-phase models of its standard 7-inch grinding and buffing machines have been announced by the Delta Power Tool Division of the Rockwell Mfg. Co., Pittsburgh, Pa. The improved models have been designed to offer higher starting torque, higher breakdown torque and lower operating costs.

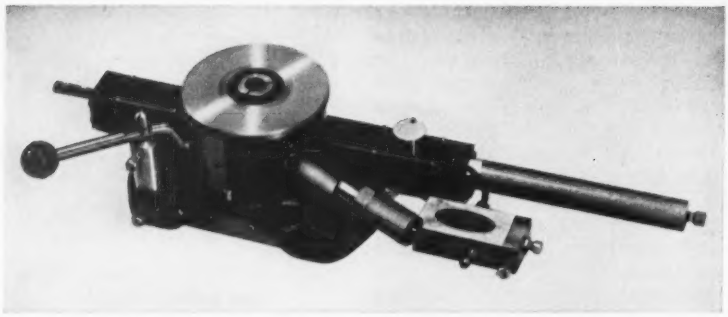
The single-phase machines feature capacitor start motors in place of the split-phase motors used on earlier models. The higher starting torque provided by the capacitor start motor means faster, easier starting, and the higher breakdown torque reduces stalling, especially in heavy grinding operations. Both the single- and three-phase models, with the exception of the 550-volt model, have been changed from single to dual voltage. The 550-volt, three-phase model is for Canadian use. .. 151

"Portelvator" for Handling Stock Sheet or Strip

A device called a "Portelvator," designed to facilitate transporting narrow sheet or strip material



Sheet- and strip-handling "Portelvator" developed by Hamilton Tool Co.



Automatic indexing fixture designed for air or hydraulic operation, manufactured by the C. & H. Mfg. Co.

has been developed by the Hamilton Tool Co., Hamilton, Ohio. The surface of the table is 26 by 72 inches and can be adjusted from a height of 24 inches to a height of 38 inches above floor level. Drop leaves increase the table length to 108 inches. These leaves are supported by four pull-bars, which retract into a space under the top surface of the table.

The table has a capacity of 5000 pounds and can be easily moved from the "low" to the "high" position. Four-point support of the load removes any possibility of tipping on ramps or uneven floors. Two 12 1/2-inch wheels and four 6-inch casters provide the shortest possible turning radius, and easiest positioning. A 30-inch retractable tongue provides a hitch for use in towing the table. 152

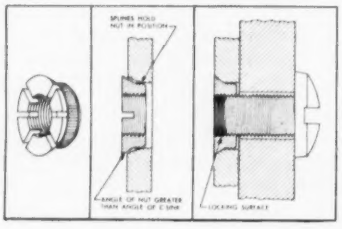
G & H Automatic Indexing Fixture

An automatic air or hydraulically operated indexing fixture that uses standard No. 22 Brown & Sharpe collets has been brought out by the G. & H. Mfg. Co., Fitchburg, Mass. This fixture can be used with any machine circuit to obtain automatic work cycling. The air cylinder on the ball handle control lever opens and closes the collet. As the table returns after making its pass under the cutters, the control timer stops the machine and opens the collet. The worker is only required to load, unload, and start the machine in its cutting cycle.

Any division in twenty-four is obtainable with the one index-plate. This is accomplished with the use of block-out screws in the index-plate. The indexing speed is adjustable. This permits building special machines or units around the index fixture and may include devices such as automatic drilling and end-milling heads. 153

Allmetal Lock-Nut

A lock-nut adapted for a wide range of metal-fastening applications has been announced by the Allmetal Screw Products Co., Inc.,



(Left to Right) The Allmetal lock-nut; nut inserted in material; and nut locked in position

Garden City, N. Y. One end of this single-piece all-metal lock-nut has a slotted conical shape, and the other is splined and cylindrical, as can be seen in the left view of the accompanying illustration. The splined section is designed to be inserted in a countersunk hole and partially or completely seated in the material (center view). The nut is held in this position by the force-fitted splines.

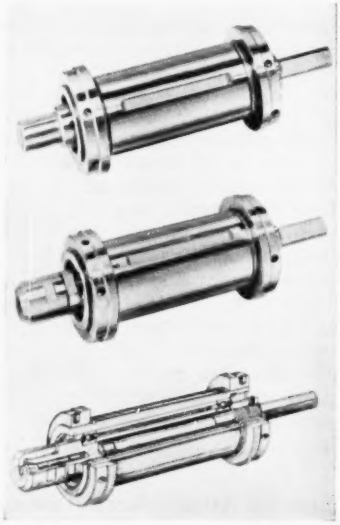
After the bolt is inserted (right view), the locking action is obtained by the pressure of the countersink surface in the work acting against the threaded sectors of the nut. This causes the threaded sectors of the nut to be forced inward against the bolt since the angle of the nut is greater than that of the countersink in the work. Thus, the locking action is effected by positive metal interference and permits the bolt to be removed and replaced without affecting the locking efficiency. The locking action is also said to remain unaffected by high temperatures. . 154

Standardized Spindles for Special Machines

A line of mass-produced standardized spindle assemblies that can be used to simplify the designing and building of special machines is announced by Russell T. Gilman, Inc., Milwaukee, Wis. They are easily incorporated in the design of any machine requiring spindles within their capacity range. Drills, reamers, taps, end-mills, and other tools of similar size can be accommodated. Spindle sockets are furnished for either a No. 0 or No. 1 Morse taper shank, or 1/8-, 3/16-, or 1/4-inch maximum capacity collets. Over-all dimensions of the spindle assemblies range from 4 5/8 to 8 inches in length and from 1 5/8 to 2 1/2 inches in diameter.

Longitudinal (in-and-out) adjustment of the spindle with relation to its mounting surface is provided by means of nuts at either end of the quill housing. These adjusting nuts are graduated in increments of 0.0005 inch on all models and sizes except the 1/8-inch collet type spindle, which has nuts graduated in increments of 0.001 inch. 155

(*This section continued on page* 233)



(Top to Bottom) Gilman Morse taper spindle; collet type spindle; and cross-sectional view of Gilman collet type spindle

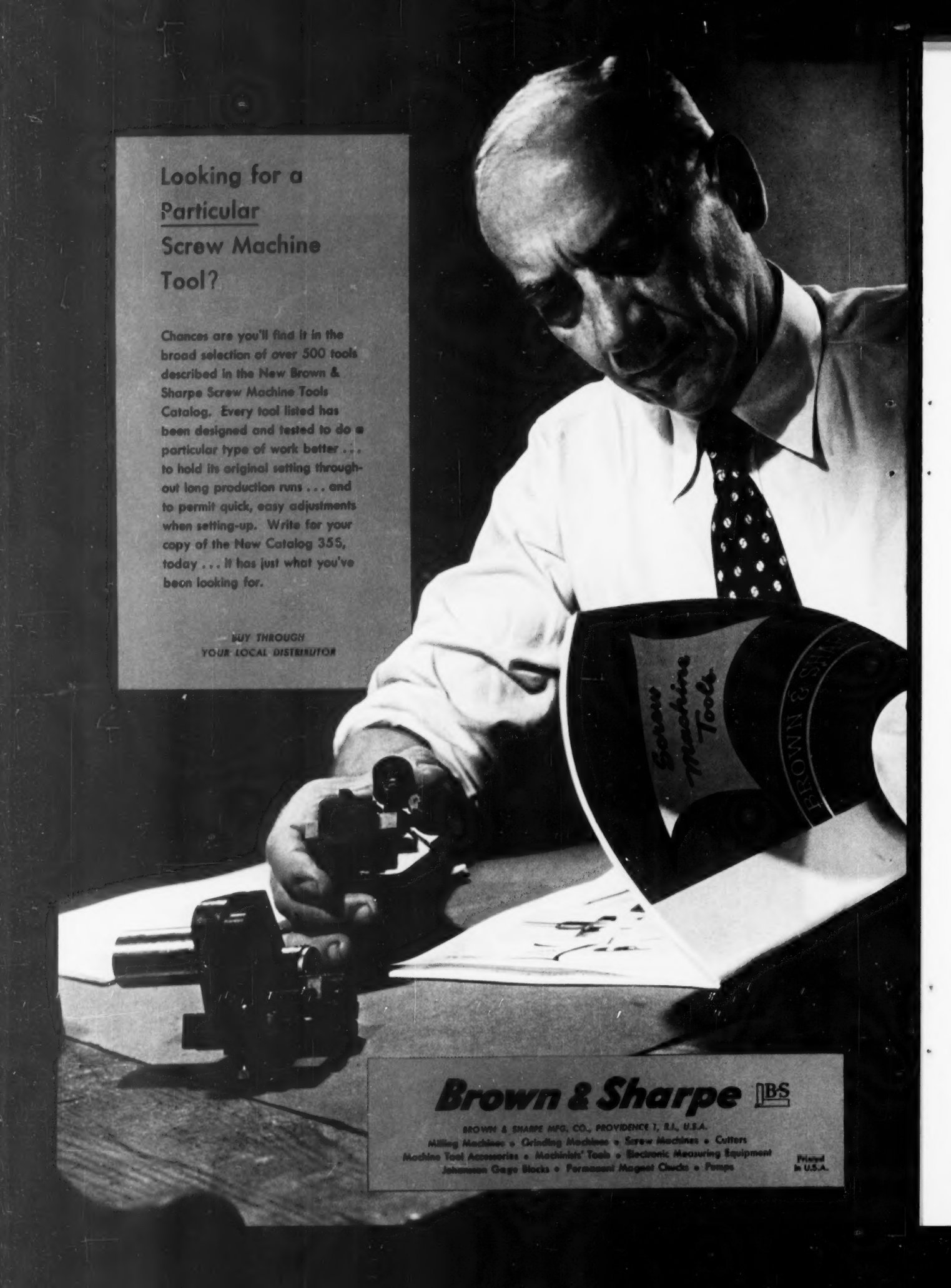
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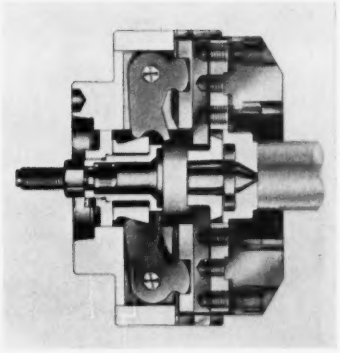


Speedier Set-ups and Output of Medium-sized Screw Machine Work . . .

The No. 4 Automatic, like all Brown & Sharpe Automatic Screw Machines, incorporates the most advanced features for high-speed, repetitive production to extremely close tolerances. In addition, it provides you with many set-up advantages of real importance: turret tools, for example, need not be set to exact distances—the No. 4 has an independent, adjustable stop for each turret position. Moreover, a separate motor for the operating mechanism can be "jogged" to facilitate positioning of tools—or a complete cycle of operation may be run through by hand. Investigate all its advantages and you'll agree: the No. 4 is the production leader in the medium-size class—an important contribution to the metalworking industry. Write for complete Bulletin.

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Compensating Chuck for Irregular Work

Compensating two- and three-jaw chucks, for rough forgings, out-of-round castings, or finished pieces with irregular gripping surfaces, have been announced by the S-P Mfg. Corporation, Cleveland, Ohio. In operation, the work is first positioned between centers, the live center being contained in the chuck body. When power is applied to the draw-screw, a cam on the spool engages levers that serve to move the jaws toward the work. 156



Boring-Bar for Radial Drilling Machines

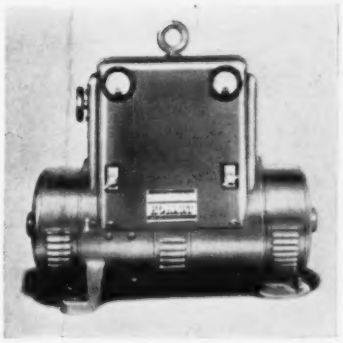
Boring-bar designed for use in radial or multiple-spindle drilling machines introduced by Belock Instrument Corporation, College Point, New York City. The standard line of bars will bore holes ranging from 1.250 to 5.812 inches in diameter. Multiple-bore bars that bore and counterbore in one operation also are available. Carbide cutters and hardened and ground stop-collars for depth of cut are features of the tool. .. 157

Self-Oiling Powdered Steel Guide-Pin Bushings

An entirely new concept has been followed in designing guide-pin bushings at the Richard Brothers Punch Division of the Allied Products Corporation, Detroit, Mich. The bushings are made of powdered steel alloy, with integral sealed internal oil wells. No external oiling is required throughout the bushing life. The structure



of powdered metal automatically assures proper lubrication to the friction surfaces. Excellent wear characteristics are claimed. The design reduces seizing and galling of the guide pins. 158

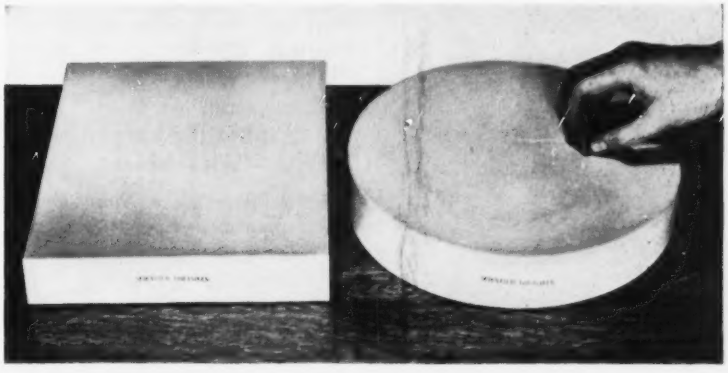


Constant Voltage Direct-Current Arc Welder

A constant voltage direct-current arc welder for inert-gas shielded-arc welding, submerged-arc welding, and other automatic processes is being marketed by Hobart Brothers Co., Troy, Ohio. Once adjusted, arc voltage remains fixed regardless of the amount of current being used. When the welding wire strikes the work, a surge of current practically vaporizes the wire and establishes an arc. The machine automatically maintains the voltage at the established value, despite changes in the speed at which the wire is fed to the arc. The welders in this new line are available in 400-, 600-, and 900-ampere capacities and are designed for operation on commonly employed electric power supply lines. 159

Fixed Abrasive Lapping Stones

Fixed abrasive lapping and polishing stones manufactured by Scientific Abrasives, and available from Abrasive Engineers, Highwood, Ill. Parts may be lapped on this stone immediately after surface grinding or fine machine finishing to obtain a 2 micro-inch finish. A finish of this kind can be obtained quickly on hardened steels as well as on soft metals. Standard size stones are 2 inches thick. Rectangular stones 10 by 12 inches and 12 by 14 inches, and circular stones 12 and 16 inches in diameter, are available. 160



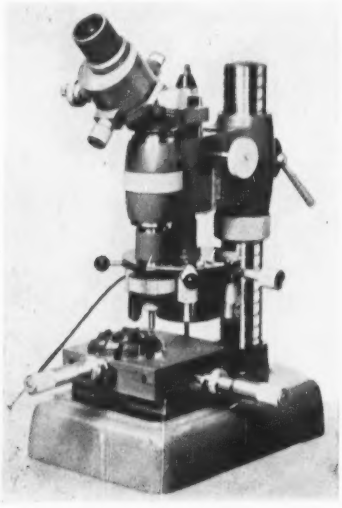


Vibratory Feeder for Small Parts

"DPS" vibrating bowl feeder added to line of feeding equipment made by the Detroit Power Screwdriver Co., Detroit 16, Mich. This feeder provides fully automatic, single-line feeding of parts or work to grinding, packaging, inspecting, and other automatic machines. It is designed to handle work that normally could not withstand tumbling, such as finish-ground or fragile parts. 161

Hardness Tester for Small Parts and Plating Deposits

Portable bench type hardness tester with diamond point having a positively controlled penetrating action and a high-power microscope of 400 magnifications. This instrument makes only minute scratches or impressions which cannot be seen with the naked eye. It is especially adapted for testing the hardness of small finished steel parts, electroplating deposits, foils, and similar materials or parts. The microscope is swung directly over the impression to permit reading the hardness by measuring with a reticule scale having 0.0005-millimeter graduations. Instructions are furnished with the instrument for converting readings into Rockwell and other standard hardness scale values. Introduced by George Scherr Co., Inc., New York City. ... 162



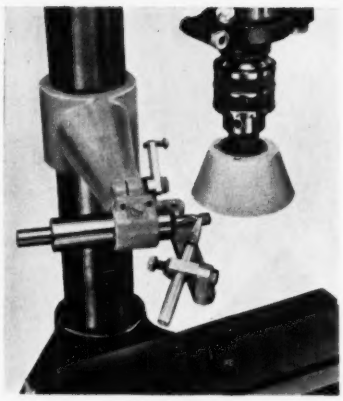


B & S Ball-Seat Gage

Special ball-seat gage made by the Brown & Sharpe Mfg. Co., Providence, R. I., to check the dimensions of ball seats on the forward mounting struts of airplane engines which must be held to very accurate tolerances. The gage shown provides an accurate check of the inside diameter of the ball seats to 0.0001 inch. In use, the gaging dimension is transferred to the dial indicator by an auxiliary plunger which rides on a cone at the back end of the gaging point. The gaging point is held against the working surface by means of a spring, and the auxiliary plunger is also held firmly against the gaging point by a spring. The dial guard protects the gage against damage. 163

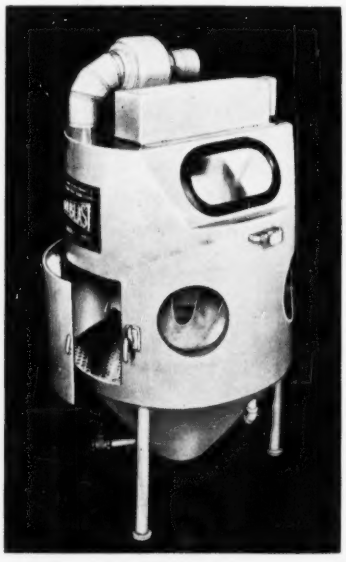
End-Mill Sharpening Attachment

End-mills can be sharpened on drill presses equipped with an attachment made by the Waterborg Machinery Co., Racine, Wis. The only items needed in addition to the attachment are an emery wheel mounted in the drill chuck and an adjustable guide finger fastened to the support bracket of the device. During the grinding, the cutter is advanced and retracted in a spiral motion, the flute remaining in contact with the guide finger. Grinding depth is controlled by the setting of the drill-press stop. To sharpen the end of the cutter, the grinding wheel is brought down across the end of each flute. . 164

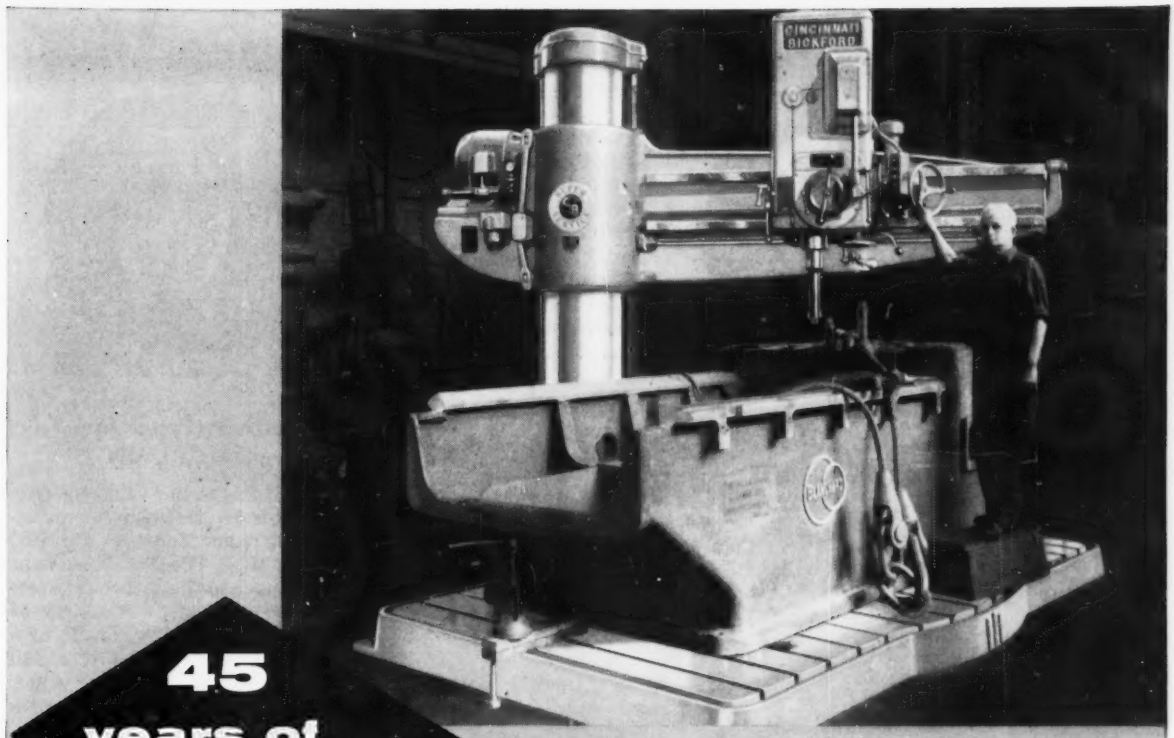


Small Jet Blast Unit

A low-cost bench model jet blast-cleaning unit for small shops has been made available by R. W. Renton & Co., Cleveland, Ohio. This unit is said to make possible substantial savings in the costs for cleaning, deburring, and etching metals. The blast of wet abrasive directed upon a surface by this unit serves to impart a fine cleaning and polishing action. The bench model is 24 inches in diameter and 43 inches high. .. 165



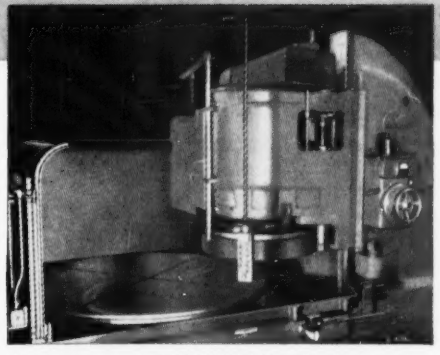
For more information on these products, use Inquiry Card, page 241



45 years of experience speaks

"Well, if you don't buy a Cincinnati Bickford let me keep the one I have."

EMILE BROUILLARD



A close-up of 42-7284 Blanchard Surface Grinder.

Photos courtesy of the Blanchard Machine Company, Cambridge 39, Mass.

Extreme accuracy is required in drilling 12 holes in base of large Blanchard Surface Grinders.

Three of these holes are for 3″ x 18″ studs, which provide column adjustment, to required flatness accuracy of .0002″ on an 84″ diameter magnetic chuck. The diameter of the three bores for the column studs are held to ± .0005″. Time on these operations was reduced an hour with the installation of this large Cincinnati Bickford Drilling Machine. This operator has not had an accident in 45 years of operating Cincinnati Bickford Super Service Radials. Twelve machines have been installed here, for their safety, production accuracy and general satisfaction.

Write for Catalog R-29.

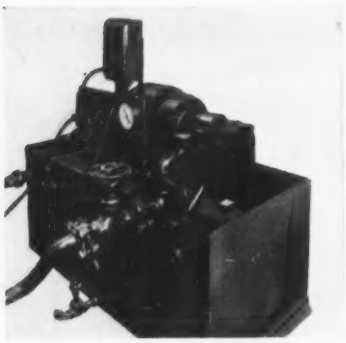
80 YEARS OF SERVICE

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

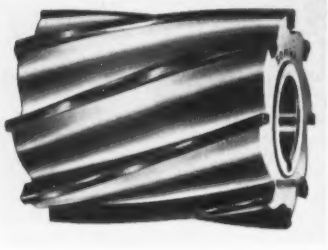
THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.



Power Unit for Operating Oil-Hydraulic Equipment

Self-contained power unit for operating oil-hydraulic equipment in either individual or group installations. Developed by the Harvill Mfg. Co., Corona, Calif., for its die-casting machines, this unit is now available in capacities from 7 to 54 gallons per minute or the delivery of pressures of 200 to 1000 pounds per square inch. Power capacities range from 7 1/2 to 30 H.P. 166



Helicarb Milling Cutter

Helical carbide slab-milling cutter recently brought out by the Sonnet Tool & Mfg. Co., Hawthorne, Calif., for heavy stock removal on wide slab cuts. This Helicarb cutter has been developed to combine the efficient cutting action of true helical flute design with the hardness of carbide and to hold the proper composite cutting angle throughout the full width of the cutter. The cutters are regularly made in 3- and 4-inch diameters and in widths from 2 to 4 inches, for both ferrous and non-ferrous cutting. 167



Plastic Welding Helmet

Safety and comfort are features of a seamless plastic welding helmet announced by the welding department of the General Electric Co., Schenectady N. Y. The plastic shell of this helmet is heat-resistant, moistureproof, and nonwarping. Its ventilating system insures cooler welding and prevents lens fogging. A four-position stop meets adjustment needs for vertical and overhead welding. The helmet is available with or without a flip-front. 168



Morse Cam Type One-Way Clutch Units

A line of 200 Series cam type one-way clutches is being manufactured by the Morse Chain Co., Detroit, Mich. These units serve as backstops and indexing or overrunning clutches in a variety of machine drives. They consist of a hardened-steel outer race, a full complement of ball-bearing cams, and two energizing springs with thrust washers and retaining plates. The clutches are ideal for general overrunning applications, since they engage instantly when torque is applied and disengage when torque is released. 170

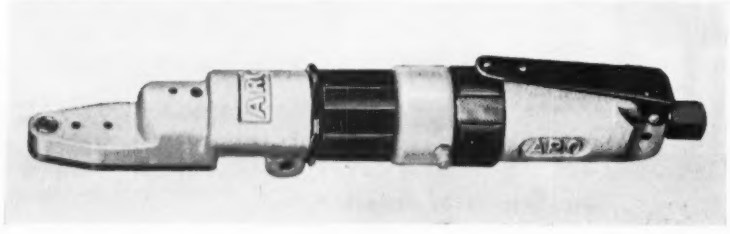


Errington Tapping Head

Universal joint tapping head announced by the Errington Mechanical Laboratory, Inc., Staten Island, N. Y. This head is designed to enable the user to speed up production and insure greater accuracy. It is available in two sizes: No. 0, with four to six spindles for No. 0 to 1/4-inch taps; and No. 1 with four, six, and eight spindles for 7/32- to 1/2-inch taps. 171

Aro Right-Angle Drill

A compact right-angle air drill for work at close-quarters is announced by the Aro Equipment Corporation, Bryan, Ohio. A unique gearing arrangement provides a head height of only 43/64 inch. Gears in the ductile cast-iron head are mounted on needle bearings. Threaded twist drills fit directly in the spindle, while cylindrical twist drills up to 1/4 inch use collets. 169

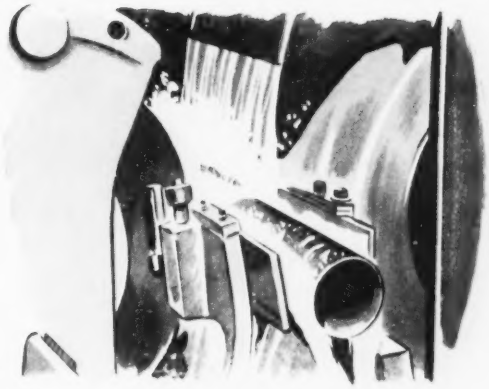


For more information on these products, use Inquiry Card, page 241

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CUTTING WITH NEW S.E.C.O. Tools stay cool—require less frequent grinding. Finishes are uniformly good.



GRINDING WITH NEW S.E.C.O. Surface finishes are good. Loading and glazing of wheel are reduced—wheel life is prolonged.



WASHING WITH NEW S.E.C.O. Thorough removal of grease and dirt provides clean surfaces for smooth, long-lasting finishes.



ROLLING WITH NEW S.E.C.O. Rolls stay clean. You get maximum reductions and low power consumption.

New Sunoco Emulsifying Cutting Oil increases production, cuts operating costs. Its high machining efficiency permits uniformly good finishes, prolongs tool life. Its high detergency and purity keep tools, parts and machines clean. Its excellent mixing qualities permit its use in cold, hard or hot water. Test New S.E.C.O. in your own plant. For more information, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. M-8.

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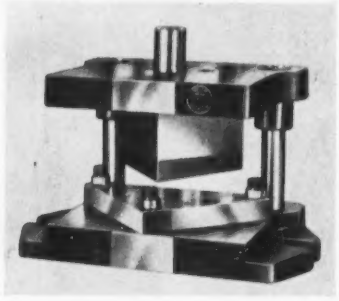
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PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Refiners of famous High-Test Blue Sunoco Gasoline

Die for Cutting V-Notches In Angle-Iron

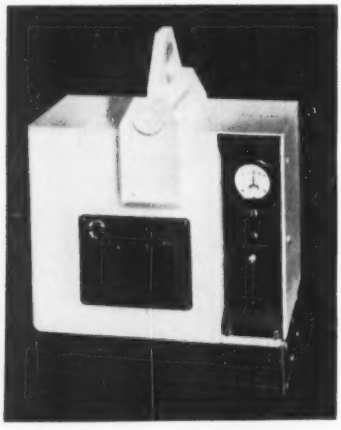
Punch and die for cutting V-notches in angle-iron so that it can be bent to an angle of 90 degrees. This press tool is manufactured by the Vogel Tool & Die Corporation, Melrose Park, Ill. It will notch an-



gles up to and including 3 by 3 inches by 3/8 inch and flat stock up to 3/8 inch in thickness. . . 172

Sundstrand Battery-Operated Lift Magnet

Lift magnet manufactured by the Sundstrand Magnetic Products Co. (Division of Sunstrand Machine Tool Co.), Rockford, Ill. This device is especially adapted for lifting machine parts and stock in machining and assembling departments and for hauling work from one department to another. It is powered by a 6-volt automobile battery and can lift 2000 pounds of finished mild steel. The magnet is operated by turning a switch. A 4-ampere battery charger, which can be plugged into any 110-volt electrical outlet, is available. The magnetizing surface is 7 by 12 1/2 inches. The unit is 12 1/2 inches high. 173



Diamond Wheels for Dry Grinding

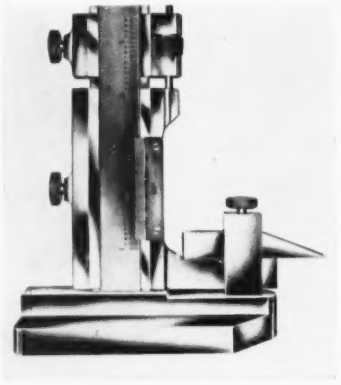
Robot resin diamond wheels for dry grinding brought out by the Action Diamond Tool Co., Chicago,



Ill. The comparatively small amount of expansion and shrinkage that takes place in these wheels during use is said to make possible the attainment of a high degree of accuracy. The non-loading feature of the bond is also claimed to result in less frequent redressing operations. 174

Foster Chromium-Plated Height Gage

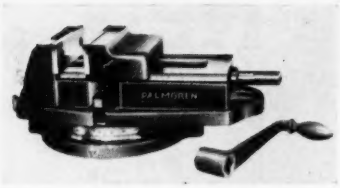
Stainless-steel height gage with chromium-plated graduations, introduced on the market by Fos-



ter Supplies Co., Chicago, Ill. Graduations and figures on this gage stand out clearly. The large 1.225-inch adjustable vernier is made of chromium-plated stainless steel. Obtainable in six sizes from 12 to 48 inches. 175

Palmgren Milling Machine Vise with Swivel Base

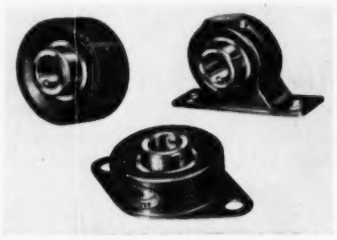
Flanged milling machine vise with swivel base recently added to the Palmgren line of the Chicago Tool & Engineering Co., Chicago, Ill. This No. 60B vise is precision built for heavy-duty service, such as milling, drilling, grinding, and other machining operations. The jaws are 6 inches wide and 2



inches deep, and can be opened to 6 inches. Removable ground-steel jaw plates are provided and the heavy Acme thread adjusting-screw is equipped with a replaceable screw bushing. 176

Rubber-Mounted Ball-Bearing Units

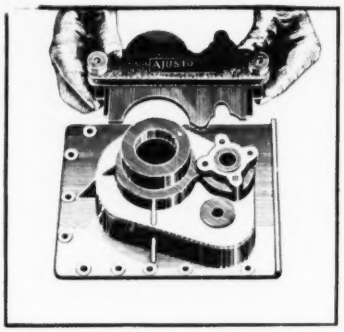
Ball-bearing units produced by the Sealmaster Division, Stephens-Adamson Mfg. Co., Aurora, Ill., are now available in rubber mount-



ings with pressed steel housings. Six shaft sizes are manufactured, ranging from 1/2 to 1 inch in pillow blocks, flange units, and cartridge units. 177

Adjustable Profile Template

A 12-inch "Ajusto" profile template is now offered to industry by the Toolcraft Mfg. Co., East Chicago, Ind. Brass laminations, 0.01 inch thick, are readily adjustable to contours up to 12 inches in

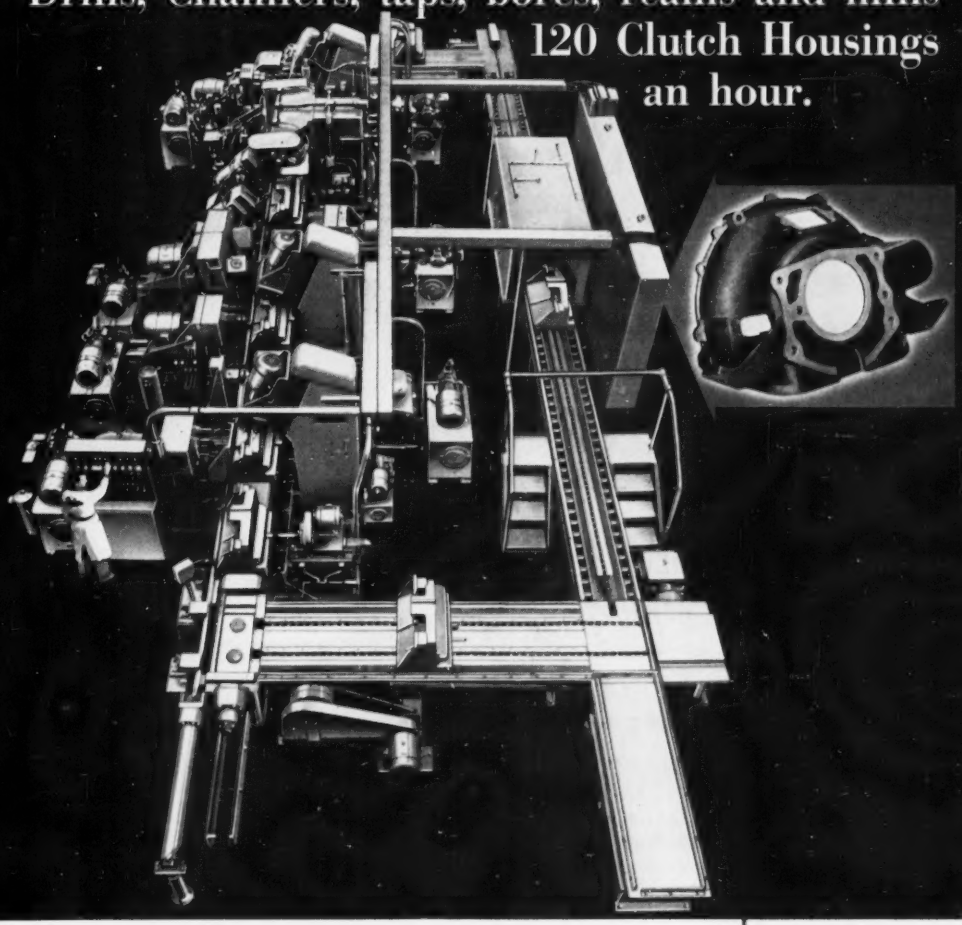


length and 4 inches in depth. Male and female profiles are obtained at the same time. A cross-bar locks the laminations in place. 178

For more information on these products, use Inquiry Card, page 241

Buhr SPECIAL...

Drills, Chamfers, taps, bores, reams and mills 120 Clutch Housings an hour.



Designed to perform identical operations on two different parts.

Through Selector Switches, change-over from one part to the other takes only seconds.

Twelve stations perform all 68 operations.

Fixtures automatically indexed from station to station, and go through Cleaning Station on return to Load Station, where Power Wrench clamps and unclamps.

Production is 120 parts per hour at 100% efficiency.

BUHR MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

TYPICAL STANDARD BUHR FEATURES INCLUDE:

- ★ Built-in chip conveyor.
- ★ Automatic lubrication throughout.
- ★ Hydraulic and electrical equipment to J.I.C. standards.
- ★ Hardened and ground tool-steel ways.

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Buhr **MULTIPLE-SPINDLE HIGH PRODUCTION MACHINERY**



How we opened the door to lower costs for Ford

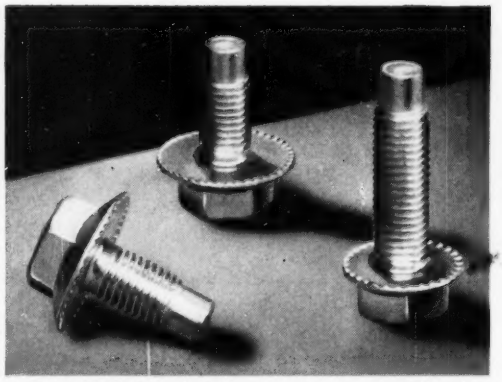
Two hinges on every Ford door. Six screws and 12 washers for each hinge.

Did this present an opportunity for cost reduction? An RB&W "fastener engineer" thought so. And after careful analysis and time studies Ford engineers agreed.

The solution: RB&W Hex SPIN-LOCK screws to fasten the hinge to the door, eliminating the need for washers. And special wide-flange Hex SPIN-LOCK screws for attaching the hinge to the frame, doing away with more washers. The wide flange is necessary to cover an elongated hole in which the hinge moves to permit accurate alignment.

Result — parts requirements are cut by two thirds, assembly is simplified, purchasing and inventory costs are lowered. And RB&W SPIN-LOCK screws hold those door hinges tight for good.

We will be glad to send an RB&W man around to check up on your fastening operations. Every problem is different, of course, but RB&W has a fastener for just about every job. If you need a "special", as Ford did, we'll design and make it for you. Write RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY, Port Chester, New York.



FASTER ASSEMBLY, reduced costs were the pay-off, using RB&W designed wide-flange SPIN-LOCK screws (left) for door hinge. Other SPIN-LOCKS (right) hold hinge on door. SPIN-LOCK screws *can't loosen* because ratchet-like teeth lock into surface and hold tight.

3.10

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For more information on products advertised, use Inquiry Card, page 241

PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On products mentioned in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

CLEANING GUIDE—Oakite Products, Inc., 126 Rector St., New York 6, N. Y. 12-page booklet containing how-to-do-it charts based on actual in-plant maintenance procedures using Oakite materials. The guide is divided into three sections: time-saving procedure charts listing the recommended cleaner to use, the concentration and temperature, and the equipment recommended for handling the cleaning job; descriptions of specially designed cleaning materials; and descriptions of equipment for applying and handling cleaning solutions. This booklet may be obtained by writing on a company letterhead direct to the above address.

FORMING AND BENDING ALUMINUM—Kaiser Aluminum & Chemical Corporation, Chicago, Ill. 272-page book with 200 illustrations entitled "Forming and Bending Kaiser Aluminum," contains factual information on working aluminum and its alloys. Forming and bending machines, tooling, lubrication, and fabricating problems are considered. Practical procedures and technical advancements in forming and bending aluminum are presented. This book can be obtained free of charge when requested on a company letterhead (or at $2 for personal libraries) to the following address: Technical Editor, Kaiser Aluminum & Chemical Sales, Inc., 919 N. Michigan, Chicago 11, Ill.

HEAT-TREATING ALUMINUM ALLOYS—Reynolds Metals Co., 2500 S. 3rd St., Louisville 1, Ky. 119-page book explaining on two different levels the principles and procedure for heat-treating aluminum alloys—the first section being a simplified presentation and the second a technical discussion for the trained engineer and metallurgist. Section 3 is devoted to tabular data on recommended heat-treating cycles and typical mechanical properties. Can be obtained when requested on a company letterhead direct to the above address.

TWIST DRILLS—Whitman & Barnes, Plymouth, Mich. Chart entitled "Twist Drill Applications," giving recommendations as to the kind of drill to use in practically all types of metals and materials. Illustrations show correct drill point angles to use for best results in various materials. Proper speeds and feeds, and recommended oils and cutting compounds are also shown. This chart can be obtained by writing on a company letterhead direct to the above address.

PHOTOGRAPHICALLY REPRODUCED TEMPLATES—Template Reproduction & Engineering Co., Philadelphia, Pa. Bulletin describing Treco Met-L-Print reproductions and comparator charts which are reproduced through a reflex photographic system from original master drawings made on steel or aluminum sheets, glass cloth, or some other dimensionally stable material. On a company letterhead, write to above concern, 401 N. Broad St., Philadelphia 8, Pa.

STATISTICAL QUALITY CONTROL—Marchant Calculators, Inc., Oakland 8, Calif. 52-page booklet consisting of a complete case history of the successful application of statistical quality control to the company's extensive manufacturing operations. Can be obtained by writing on a company letterhead direct to the above address.

FLAME-PLATING—Linde Air Products Co., a Division of Union Carbide and Carbon Corporation, New York City. 16-page booklet on flame-plating, a process for depositing thin coatings of tungsten carbide on the surfaces of parts and many tools where extra resistance to wear is required. The advantages of flame-plating are described and detailed information on successful applications is given. Two questions are answered: What is the cost of flame-plating? and Where should you use flame-plating? 1

WELDING ALUMINUM — Aluminum Company of America, Pittsburgh, Pa. 176-page book describing the latest developments in the science of welding aluminum. Photographs and drawings are coupled with a comprehensive text to illustrate all the practical methods that can be used, including torch welding, arc welding, resistance welding, and pressure welding. Thirty-one tables of technical data are given and there is a chapter devoted to quality control and various inspection methods. 2

HYDRAULIC GRINDERS—Rivett Lathe & Grinder, Inc., Boston, Mass. Bulletin 1024-B, 16 pages describing the Rivett internal and universal hydraulic grinder, which combines the features found separately in an internal grinder and in a plain external grinder. Illustrated are various internal grinding operations, such as small-hole, deep-hole, and taper grinding; and external grinding operations, such as straight shaft, long shaft, and diameter and shoulder grinding. 3

CRUCIBLE PUBLICATIONS — Crucible Steel Co. of America, Pittsburgh, Pa. Catalogue listing publications—manuals, technical aids, and data sheets—that have been compiled by Crucible specialists as a result of research projects carried on at the company and experiences in the field. After reviewing the publications listed, those in which you are interested can be obtained from the company, ordering by number. 4

OVERHEAD MATERIALS-HANDLING EQUIPMENT—Cleveland Tramrail Division, Cleveland Crane & Engineering Co., Wickliffe, Ohio. Booklet 2008-K, engi-

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neering and application data covering the company's overhead materials-handling equipment, consisting of a number of standard items such as rail, switches, carriers, cranes, and hoists—which can be combined to serve nearly every materials-handling problem. **5**

HYDRAULIC OILS FOR DENISON PRESSES—Denison Engineering Co., Columbus, Ohio. Catalogue 45, containing 15 pages of factual information on the selection and use of hydraulic oils for Denison equipment. Factors affecting hydraulic oil performance are considered, as well as procedure to assure suitable oil condition. In conclusion, there is a section devoted to operating notes. **6**

ENGINE-DRIVEN WELDERS—Lincoln Electric Co., Cleveland, Ohio. Bulletin 1337, giving the general design and construction of Lincoln "Shield-Arc" industrial direct-current welders. Various models are described—a gasoline engine-driven welder with dual control; a Diesel engine-driven welder with dual continuous control; and three gasoline engine-driven welders with dual continuous control. **7**

BROACHING MACHINES — Colonial Broach Co., Detroit, Mich. Bulletin RU-54, describing the Colonial improved Series RU pull-up broaching machines, suitable for internal broaching of rounds, splines, squares, and gear teeth, as well as for "second pass" broaching operations. The design and operating features are covered in a blueprint. **8**

BLAST CLEANING AND DUST CONTROL EQUIPMENT—Pangborn Corporation, Hagerstown, Md. Bulletin 1210, a condensed 24-page bulletin of Pangborn machines listed by equipment, by type, and by purpose. The bulletin begins by discussing Rotoblast, Airblast, and hydraulic methods of abrasive application, and then illustrates the various types of equipment which make use of these three basic principles. **9**

WHEEL-FORMING ATTACHMENT—Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. Circular 574, descriptive of the Diaform wheel-forming attachment for cutter relief angle compensation, which simplifies the grinding of tools where rake or relief (both end and side) must be taken into consideration in order to form a true profile at the cutting edge. **10**

ALLOY-STEEL TUBING MILL STOCK—Timken Roller Bearing Co., Canton, Ohio. Booklet on Timken seamless mechanical tubing in two alloy-steel grades maintained in stock—52100 tubing (an oil-hardening grade) and "Nickel Moly" tubing (a carburizing steel). Listed are the sizes and finishes, the dimensions to which they may be safely machined, and their foot weights and prices. **11**

ABRASIVE AND CUTTING TOOLS—Metal Removal Co., Chicago, Ill. 40-page catalogue in two sections—the abrasive section presents sizes, shapes, and bonds of mounted points, small grinding wheels, and segments; while the cutting tool section contains specifications on carbide and high-speed steel rotary files, internal grinding tools, and end-mills. **12**

PRESS BRAKES—Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 89-C, 32 informative pages introducing the company's new line of press brakes of 50- through 775-ton capacities. Included are specification tables, fundamentals of press brake work, and data for computing bending, punching, and blanking tonnages. **13**

AIR CONTROL VALVES—Ross Operating Valve Co., Detroit, Mich. Bulletin 101B, describing and illustrating three fundamental types of air control valves—an integral pilot-operated, a remote control, and a direct-operated. Diagrammatic drawings show how the air flows through the valve and to the operated cylinder. **14**

PRESSES—Interstate Machinery Co., Inc., Chicago, Ill. 16-page booklet entitled "How to Choose the Right Press," dividing into various types the presses that are available so that the press best suited to do your job may be selected. Press terms are concisely explained. A formula is included on how to determine capacity. **15**

METALS RESEARCH FACILITIES—Armour Research Foundation of Illinois Institute of Technology, Chicago, Ill. 14-page booklet summarizing facilities available for metals research by the Foundation. The various fields in which metals research is done are considered from the viewpoint of purpose, who, what, and how. **16**

UNIVERSAL INTERNAL GEAR-FINISHING MACHINE—Modern Industrial Engineering Co., Detroit, Mich. Bulletin 103-81, featuring the new Burr-Master universal internal spline and gear deburring-chamfering machine. Briefly described are the operating cycle, the work range of the machine, and mechanical details. **17**

GRINDING-WHEEL SPINDLE BEARINGS—Cincinnati Milling Machine Co., Cincinnati, Ohio. Bulletin G-604 entitled "X-Ray Story of Filmatic," containing complete details about Filmatic spindle bearings, and explaining the design principle which assures both rigidity and low friction. **18**

WORK-HOLDING FIXTURE — Skinner Chuck Co., New Britain, Conn. Bulletin PCF-67, descriptive of the Skinner power chuck fixture, a non-rotating air-operated work-holding fixture for use on drilling and milling machines, for assembly operations, and for other bench and machine installations. **19**

INSERT CHASER DIE-HEADS—Eastern Machine Screw Corporation, New Haven, Conn. Bulletin 11C, containing a brief description of H&G rotary type insert chaser die-heads designed for use on multiple-spindle automatics or any machine where the die head rotates, such as chucking machines, bolt threaders, and drill presses. **20**

REINFORCED RESINOID PRODUCTS—Norton Co., Worcester, Mass. Catalogue 1748, consisting of 28 pages on the Norton reinforced resinoid line of grinding wheels, mounted wheels and points, and sticks. Typical application photographs, tables of wheel sizes, prices, operating speeds, and other helpful data make up this booklet. **21**

SHELL MOLDING—General Electric Co., Pittsfield, Mass. Manual CDC-272, describing the latest developments in shell molding and showing how this new casting process has reduced machining and

Product Information Service

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finishing costs as well as foundry time. Case histories, testing methods, and production techniques are treated. **22**

SCALE MODELS—Arthur B. Johnson & Co., Inc., New York City. Booklet K, illustrating a number of three-dimensional models produced by the company in metal, wood, and plastic. These models, made to user specifications, aid in development and research work, plant lay-out, and construction estimating, for example. **23**

STEAM DROP-HAMMERS—Erie Foundry Co., Erie, Pa. Bulletin 355, describing Erie steam drop-hammers, rated from 1000 to 75,000 pounds. The construction of the hammers, standard dimensions, and material specifications are covered, and their use in diversified industries illustrated. **24**

CHUCKING REAMERS—Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. Circular 571 giving in tabular form the sizes of P&W high-speed steel chucking reamers with straight shank and taper shank. A precision job using these reamers is shown. **25**

DUCTILE CAST IRON—International Nickel Co., Inc., New York City. Bulletin DI-2, consisting of an 8-page reprint on the engineering applications of ductile cast iron, a relatively new engineering material in the ferrous field. Successful applications are presented. **26**

POWER SQUARING SHEARS — Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 69D, containing 39 pages of comprehensive information on the entire line of Niagara underdrive power squaring shears for plate and sheet-metal work, with shearing capacities up to 1-inch thick mild steel in lengths of 3 to 20 feet. **27**

TAP SHARPENING—Edward Blake Co., West Newton, Mass. Bulletin 654, showing by means of "how to do it" photographs and diagrams Blake flute grinders. These machines will handle right- and left-hand taps from smallest to 5/8-inch diameter with two, three, or four flutes. **28**

PRESSES—Dreis & Krump Mfg. Co., Chicago, Ill. Circular SS-54, illustrating and describing Chicago SS presses having capacities of from 30 to 400 tons and large die areas, for blanking, drawing, die-cutting, forming, notching, punching, and trimming operations. **29**

THIN-SECTION BEARINGS—Kaydon Engineering Corporation, Muskegon, Mich. Engineering Catalogue 54, containing 24 pages of charts and data on Reali-Slim bearings. These bearings are designed for use where minimum bearing weight is required, such as in the aircraft industry. **30**

COMBINATION HYDRAULIC MOTOR AND SPEED REDUCER—Oilgear Co., Milwaukee, Wis. Bulletin 56610, giving technical information on "Oilgearducers," packaged output units. Each unit consists of an Oilgear axial piston motor coupled to a Falk speed reducer. The method of selection is explained. . . **31**

HYDRO-BROACH MACHINES—Cincinnati Milling Machine Co., Cincinnati, Ohio. Catalogue M-1848, describing Cincinnati duplex vertical hydro-broach machines. The subject of surface broaching is considered, and several applications are illustrated, such as nine surfaces being broached in two operations. **32**

BAR AND CHUCKING MACHINES—Cone Automatic Machine Co., Inc., Windsor, Vt. Bulletin on Conomatic multiple-spindle bar automatics which are available in forty models. A brief description of the basic features of these machines is presented in this "Datalog." **33**

FLOW CONTROL VALVES—Denison Engineering Co., Columbus, Ohio. Catalogue on an expanding line of Denison engineering equipment. Three items are described: multiple-range flow control valves; direct-operating pressure controls; and pilot-operated check valves. **34**

CENTERLESS GRINDERS—Landis Tool Co., Waynesboro, Pa. Bulletin describing two models of Landis precision centerless grinders, which may be used for through-feed or in-feed grinding of large or small quantities. Straight, formed, or tapered work can be handled on these machines. **35**

CHUCKING MACHINES—Cone Automatic Machine Co., Inc., Windsor, Vt. Bulletin giving concise information on six-spindle Conomatic chucking machines. The construction of the machine is shown in detail by means of 66 reference numbers and two pages of dimensional data are included. **36**

ROTARY FILES — Rota-File Corporation, Brooklyn, N. Y. Bulletin containing information to help in the selection of the various standard shapes and sizes of available Rota-Files. Also described are the company's special and regrinding services. **37**

ADJUSTABLE-TORQUE TAP DRIVERS—Scully-Jones & Co., Chicago, Ill. Bulletin 20-50, featuring the new Scully-Jones releasing, adjustable-torque drivers for taps. How the driver stops tap breakage in two ways is explained. **38**

PLAIN AND SELF-LOCKING NUTS — National Machine Products Co., Utica, Mich. Catalogue descriptive of Twelve

(Continued on next page)

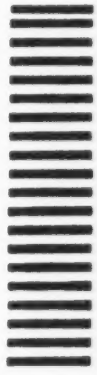
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Pointer plain and self-locking nuts, which are designed to permit smaller tool clearances than is practical with hexagon nuts. **39**

VARIABLE-SPEED MOTOR DRIVES—Reeves Pulley Co., Columbus, Ind. Bulletin M-543, describing the Reeves fractional-horsepower Vari-Speed Motodrive available in speed ratios of 2 to 1 through 10 to 1. Advice on how to select the proper unit is given. **40**

HYDRAULIC PRESSES—Greenerd Arbor Press Co., Nashua, N. H. Catalogue 54, descriptive of Greenerd hydraulic presses in capacities from 1 1/2 to 75 tons. Some special hydraulic presses are also illustrated. **41**

FEEDS AND SPEEDS FOR DRILLS—Chicago-Latrobe Twist Drill Works, Chicago, Ill. Helpful technical data in chart form on safe feeds and speeds when using high-speed drills for various materials. **42**

LOCK-NUTS—MacLean-Fogg Lock Nut Co., Chicago, Ill. Catalogue descriptive of a new lock-nut—the M-F Uni-Torque lock-nut, a semi-finished hexagon nut which spins freely onto the top threads and then must be tightened with a wrench. **43**

THREADING HEADS—Landis Machine Co., Waynesboro, Pa. Bulletin F-90-2, giving in 27 pages detailed data on Landis heat-treated threading heads, both standard and special. The die heads are illustrated and specifications provided. **44**

ELECTRONIC REGULATOR—Reliance Electric & Engineering Co., Cleveland, Ohio. Bulletin K-2076, describing the Reliance VSR—a newly developed electronic regulator for speed, voltage, and current (tension) regulation of industrial electric motor drives. **45**

ALTERNATING-CURRENT WELDER—Lincoln Electric Co., Cleveland, Ohio. Bulletin 1344, descriptive of the "Fleetwelder Special," a low-priced Lincoln alternating-current welder, providing a wide welding range. **46**

AIR-POWERED SCREWDRIVERS — Ingersoll-Rand, New York City. Bulletin 5056A entitled "Production Payoff," consisting of 20 pages of helpful information on air-powered screwdrivers. Examples are presented of jobs where air engineering speeds assembly of a variety of products. Time, labor, and cost-saving data are given for each job. **47**

COLD EXTRUSION—Koldflo Division, Mullins Mfg. Corporation, Salem, Ohio. Booklet giving examples of how certain tubular products are formed by the Koldflo method, a process of extruding steel in its cold state. **48**

VARIABLE-SPEED DRIVES—Speed Selector Inc., Cleveland, Ohio. Folder 46, on two models of compound variable-speed drives, showing diagrammatically their design features of these versatile power transmission components. **49**

FILTRATION EQUIPMENT—Cuno Engineering Corporation, Meriden, Conn. Catalogue 054, on Cuno Micro-Klean and Auto-Klean filters. Operating instructions for filtering paint products are given. **50**

MANUFACTURING FACILITIES—Hardinge Mfg. Co., York, Pa. Bulletin AS-456, describing the facilities for "farmed-out" work of this medium-sized manufacturing f[illegible], and illustrating some custom-built machinery. **51**

DRILLING MACHINES—Western Machine Tool Works, Holland, Mich. Catalogue 5415, describing and illustrating eighteen-speed Western heavy-duty, upright drilling machines. **52**

METAL CLEANING — Manufacturers Processing Co., Detroit, Mich. 23-page manual entitled "Vapor Degreasing Do's and Don'ts," showing the right and wrong methods of vapor degreasing. **53**

SOLDERING FLUXES—Alpha Metals, Inc., Jersey City, N. J. Folder descriptive of Alpha non-corrosive and general-purpose fluxes. **54**

HARDENABILITY OF STEELS—International Nickel Co., Inc., New York City. Bulletin A-63 entitled "Some Aspects of the Hardenability of Steels," a 12-page reprint documented with charts and photomicrographs. **55**

JIG AND FIXTURE COMPONENT CHART—Northwestern Tool & Engineering Co., Dayton, Ohio. Conversion chart giving comparative catalogue numbers of over 100 jig and fixture components produced by seven leading manufacturers. **56**

GAGING EQUIPMENT— Cleveland Instrument Co., Cleveland, Ohio. Bulletin 542, describing and illustrating Cleveland electronic gaging equipment for dimensional inspection and control applications. **57**

COPYMATIC LATHES—Lodge & Shipley Co., Cincinnati, Ohio. Bulletin 46, illustrating an operation in which a Copymatic heavy-duty lathe is contour-turning a bearing cartridge. **58**

GRINDING COOLANT—Motch & Merryweather Co., Cleveland, Ohio. Leaflet descriptive of Triple C grinding coolant, a water-soluble compound for all wet-grinding operations. **59**

IMPACT SOCKETS—Apex Machine & Tool Co., Dayton, Ohio. Catalogue 29-A, descriptive of Apex impact sockets designed for use with large-capacity impact tools. **60**

HIGH-SPEED STEEL—Firth Sterling, Inc., Pittsburgh, Pa. Bulletin SL-2077, a high-speed steel stock list comprising over 800 sizes in five grades. **61**

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38	39	40	41	42
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171	172	173	174	175	176	177	178						

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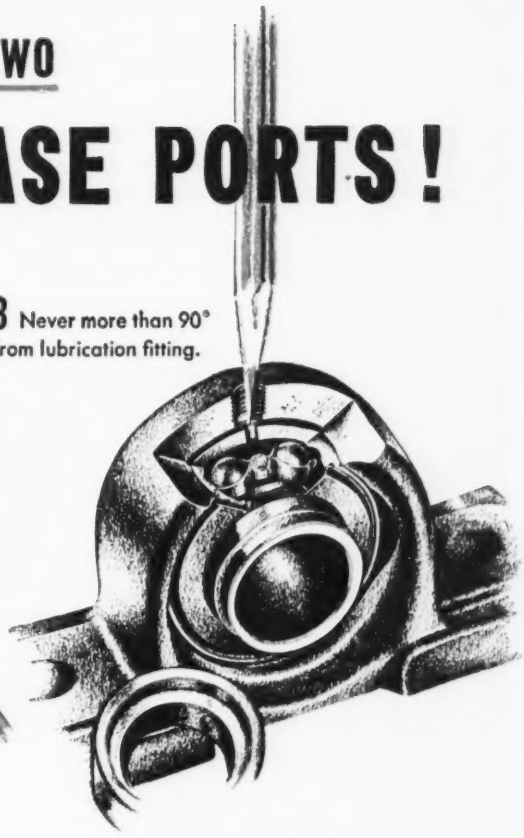
preference points on power transmission units

Not one but two GREASE PORTS!

A Two grease ports . . . 180° apart.

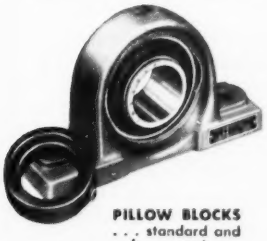


B Never more than 90° from lubrication fitting.



If you select power transmission units with re-lubrication in mind, you'll appreciate the importance of the Fafnir two-grease-port design to dependable ball bearing performance. There is always one grease port in the bearings' outer ring that is never more than 90° from the lubrication fitting . . . and this fitting, incidentally, can be your own type because Fafnir provides standard pipe plugs.

Point by point comparisons of design features, from the Fafnir-originated wide inner ring ball bearing with self-locking collar . . . easiest of all to install . . . to the frictionless Mechani-Seals . . . explains the steadily-growing preference for Fafnir Ball Bearing Power Transmission Units. For details, call your nearby Fafnir distributor. The Fafnir Bearing Company, New Britain, Conn.



PILLOW BLOCKS
. . . standard and heavy series



FLANGE CARTRIDGES
. . . standard and heavy series



CYLINDRICAL CARTRIDGES
. . . standard and heavy series

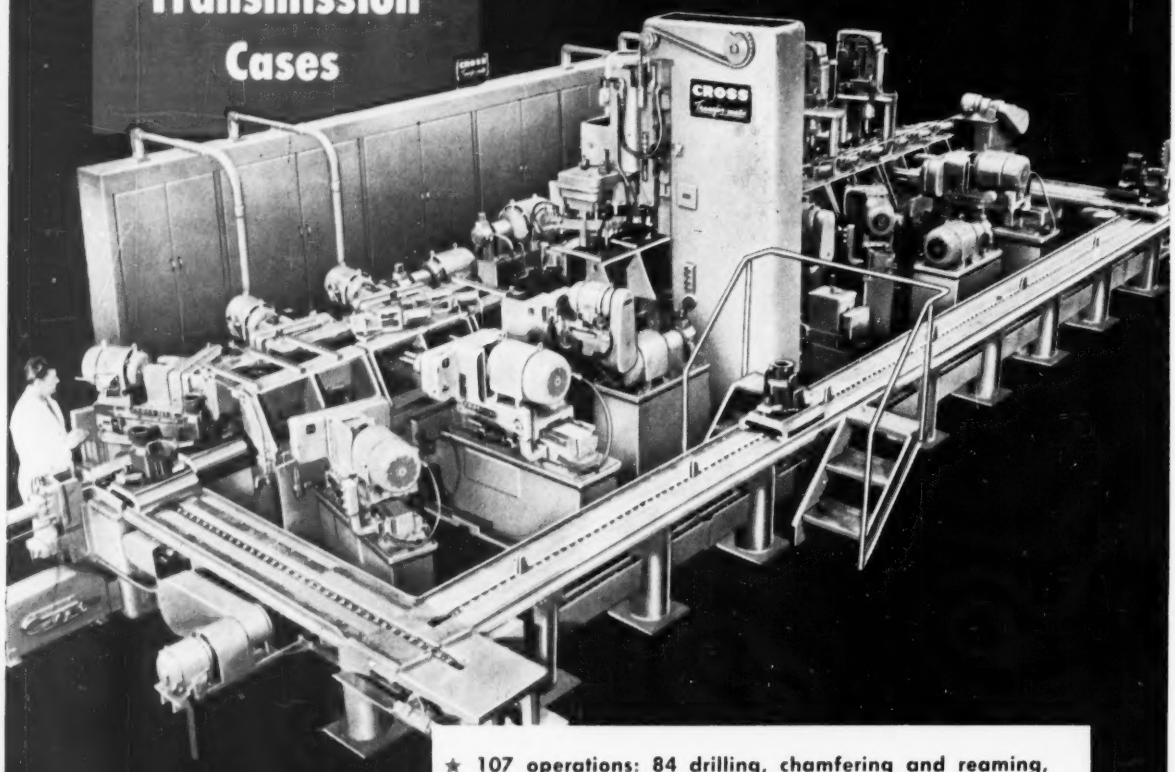


WIDE INNER RING BALL BEARINGS
. . . with Mechani-Seals

FAFNIR
BALL BEARINGS
MOST COMPLETE LINE IN AMERICA

Drills, Bores, Reams and Taps Transmission Cases

Another Transfer-matic by Cross





★ 107 operations: 84 drilling, chamfering and reaming, 8 spotfacing and counterboring, 4 boring, 6 tapping, 5 inspection.

★ 95 parts per hour at 100% efficiency.

★ 21 stations: 1 for loading, 1 for unloading, 15 for machining, 4 idle.

★ Machine stops automatically if critical tools are broken or improperly set for depth.

★ Pallet type work holding fixtures with automatic transfer from station to station and integral conveyor for automatic moving from unloading to loading station.

★ Complete interchangeability of all standard and special parts for easy maintenance.

★ Other features: Hardened and ground ways, built-in chip conveyors, hydraulic feed and rapid traverse, individual lead screw feed for tapping, automatic lubrication and J.I.C. construction.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 241



Between Grinds

By E. S. Sallchs

Booth or Berth?

The National Metal Show and the National Motel Show begin simultaneously in Chicago on November 1. While this is undoubtedly a coincidence, if you are attending the Metal Show and can't book a room in Chicago, perhaps you can snatch ten winks and a shower in a model motel by flashing your badge—but quickly.

Even the Pills Have Ills

A drug manufacturer was getting a production headache in drying a subcoating on tablets—took too long, too much moisture was left in them. The condition was cured by putting one 800-watt Chromalox electric radiant heater in each tumbler that applies and dries the coating.

No Time Like Coffee Time

Coffee vending machines at a 75-person Chicago plant operate two ways—the company switches the machines to free service during coffee break periods; rest of the day they operate by coin.

Miss Your Train and You Miss the Boat

The Great Northern Railway, according to *Wheels*, has a finishing school for its traffic representatives who travel 3000 miles while learning. Ahead of time, each man receives a five-page memorandum (timetable) explaining what he will be doing during the eleven-day semester.

Strong- and Air-Minded

Some of the pictures left over from the July Aircraft number were forwarded by the Editor to a ten-year old friend, Jimmie Graham,—a budding space cadet—in Whittier, Calif. A thank-you letter from Jimmie informed the Editor that the pictures had been displayed in school and "The teacher tried to talk me out of some but it didn't work."

And Don't Slam It, Richard

The largest single doorway in the United States, belonging to a new hangar, is 780 feet long and 65 feet high, with thirteen vertical lift doors.

Timken's Tombs

An atomic bomb proof vault will be built by the Timken Roller Bearing Co. at its New Philadelphia plant. The vault will safeguard valuable microfilm records, such as the company's 375,000 engineering drawings. Which reminds us—we meant to tell our readers long before this about MACHINERY being available on microfilm (Vol. 59, one whole year in two reels, costs $15 and can be obtained from University Microfilms, Ann Arbor, Mich.).

With Tender Care

From the Brooklyn Steel Warehouse Co. comes the announcement—"We can store your baby locomotives . . ."



TAKING ON ANOTHER TASK—Ralph E. Cross, executive vice-president of The Cross Company, being sworn in by Secretary of Commerce Sinclair Weeks as Assistant Administrator of the Business and Defense Services Administration, United States Department of Commerce. On leave from his company, Mr. Cross is participating in forming plans and policies for the Government under the rotation system (whereby outstanding businessmen serve without compensation for periods of six months or longer). He has already been with BDSA since February as Director of the Metalworking Equipment Division. In the machine tool industry, one of Mr. Cross's innovations is a Transfer-matic for automotive V-8 cylinder blocks capable of performing 555 operations under the direction of a single operator. Mr. Cross can Work Wonders in Washington!

News OF THE INDUSTRY

California

FRANKLIN H. DREW has been appointed to the newly created position of Pacific Coast service manager for the Westinghouse Electric Corporation, Pittsburgh, Pa. Mr. Drew will retain his headquarters at 410 Bush St., San Francisco, Calif., where he has been steam superintendent for the region since 1946.

REVERE COPPER & BRASS INC., New York City, recently announced that the BAKER STEEL & TUBE CO. has been appointed distributor of Revere aluminum tubing on the West Coast. The Baker concern is located at 1400 Calzona St., Los Angeles, Calif.

READY TOOL CO., Bridgeport, Conn., has appointed LITTLEJOHN CO., as representative for southern California, Arizona, and southern Nevada. The representative has offices at 4511 Melrose Ave., Los Angeles.

ROBERT L. BOGGS was recently appointed sales engineer for the Butterfield Division, Union Twist Drill Co., Derby Line, Vt. Mr. Boggs will represent the Division in the southern California territory, with headquarters in Los Angeles.

HARRY BOYER was recently appointed representative on the West Coast and for the Rocky Mountain States by the Brad Foote Gear Works, Inc., Cicero, Ill. He resides at 6106 Vista de la Mesa, La Jolla, Calif.

ROBERT H. CLARE has been named a salesman in the eleven-state West Coast territory by the Standard Pressed Steel Co., Jenkintown, Pa., with headquarters at El Segundo, Calif.

Michigan

WILLIAM T. CHERRY has been named manager of application engineering by the Formsprag Co., Van Dyke, Mich., manufacturer of sprag type clutches for the automotive, aircraft, and industrial fields. Mr. Cherry has been with the company for the last five years in the production, engineering, and sales departments. ROBERT B. MADONIA will assume Mr. Cherry's former duties.

BERTON E. ROGERS has been named general factory manager of Vickers Incorporated, Detroit, Mich. In his new position, Mr. Rogers will be in charge of manufacturing and production activities at Vickers plants in Detroit, Omaha, and Joplin. He was formerly vice-president in charge of manufacturing for the Motor Products Corporation.



Berton E. Rogers, who is joining Vickers Incorporated as general factory manager

PETER J. JENSEN has been named manager of manufacturing by the Carboloy Department of General Electric Co., Detroit, Mich. Mr. Jensen was previously manager of the Michigan sales district. He joined the Department as a tool engineer in 1937. JOHN A. MULDOON succeeds Mr. Jensen as Michigan district sales manager. He also has been with Carboloy since 1937.



Peter J. Jensen, new manager of manufacturing at Carboloy Department of General Electric Co.

T. J. RANCONT has been appointed Detroit district sales manager of the Producto Machine Co., Bridgeport, Conn. This branch is located in the new Producto Headquarters Bldg., at 10200 Capitol Ave., Detroit, Mich.

CHARLES H. CRAWFORD has been appointed plant manager of the Colonial Broach Co., Detroit, Mich.



Charles H. Crawford, who recently joined the Colonial Broach Co. as plant manager

Mr. Crawford comes to Colonial after thirty-four years with the Mack Truck Co. He was most recently New Brunswick, N. J., plant manager for Mack.

JULES F. HALM, treasurer and assistant secretary of the Allied Products Corporation, Detroit, Mich., recently retired after twenty-three years of service. V. LEONARD HANNA, controller for the Corporation, has been given the additional duties of treasurer, while PETER C. FORTUNE has been made assistant secretary.

MILTON J. STEFFES, sales manager of the Super Tool Co., Detroit, Mich.,

PERHAPS YOU, TOO, CAN MAKE A BETTER PRODUCT WITH REVERE EXTRUDED SHAPES

This new Oxy-Acetylene welding torch is notable for the use of Revere Extruded Shapes in free-cutting brass—and also for its light weight, good balance, and easy handling. The connection for the gas tubes is machined from a shape, and silver-brazed to the fluted handle, also a shape, which is in turn brazed to a shape that contains the needle valve controls. Another fluted shape is the mixer, and the same shape is also the source of the next part, which is a second mixer. Another shape forms the nut which attaches the nozzle to the assembly. The nozzle, by the way, is made of Revere Free-Cutting Copper Rod, which is upset, drilled, swaged to size, and then chrome plated. The manufacturer of this new torch came to Revere to learn about the possibilities of extruded shapes.

If you have a product whose design includes a part or parts calling for extensive machining along the longitudinal axis, such as flutings, curves, recesses, remember Revere Extruded Shapes. They can greatly reduce machining time, lessen scrap, lower production costs, and speed up output. See the nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

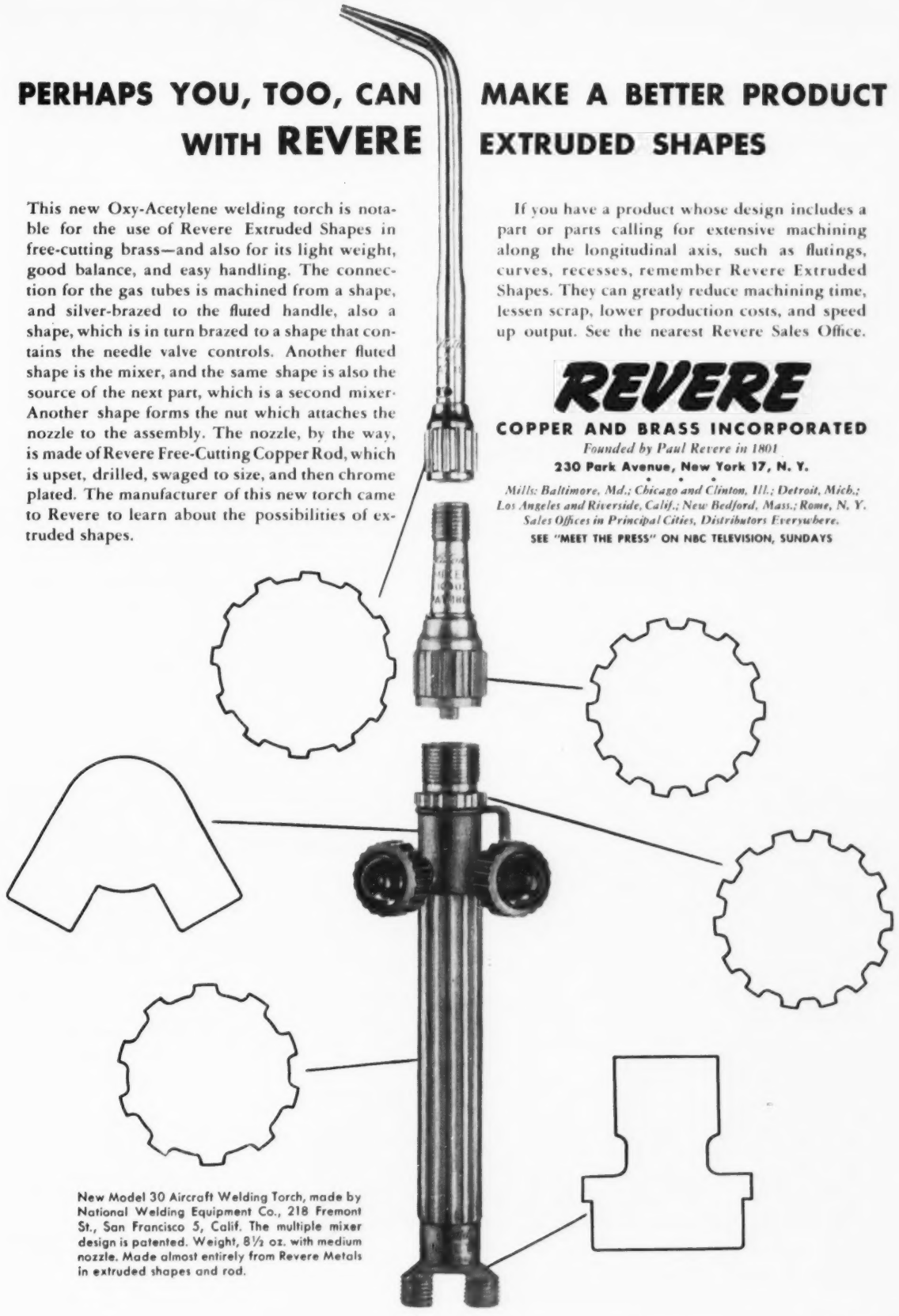
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.
Sales Offices in Principal Cities, Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS



New Model 30 Aircraft Welding Torch, made by National Welding Equipment Co., 218 Fremont St., San Francisco 5, Calif. The multiple mixer design is patented. Weight, 8½ oz. with medium nozzle. Made almost entirely from Revere Metals in extruded shapes and rod.

has been promoted to chief engineer. KENNETH R. FISHER succeeds Mr. Steffes as sales manager. He was formerly a carbide tool field sales representative. LOUIS B. SZAL, having been promoted to works manager, will be placed in charge of both the Detroit and Elk Rapids plants.

DOROTHY M. J. TRACEY was recently elected president of the Tomkins-Johnson Co., Jackson, Mich., succeeding the late A. R. Johnson, her father. The company manufactures air and hydraulic cylinders, riveters, die-sinking milling cutters, and reamers.

METAL TREATING EQUIPMENT EXCHANGE is a new organization in the used machinery field, located at 9825 Greeley, Detroit 11, Mich.

ROMULUS TOOL & ENGINEERING CO., has moved to its new building at 13581 Huron River Drive, Romulus, Mich.

New England

DR. HARRY WALKER has been appointed vice-president of the Norma-Hoffmann Bearing Corporation, Stamford, Conn., in charge of the newly formed Walker Division. This division will be engaged in the manufacture and sale of selenium and other types of dry disc rectifiers.

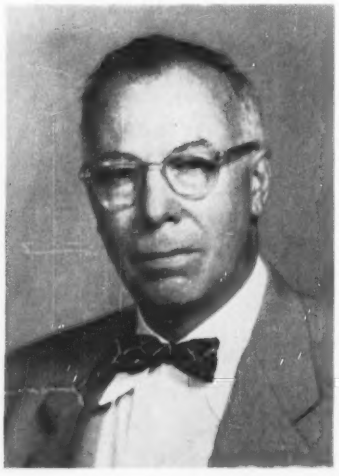
RAYMOND S. FOX was recently promoted to the position of chief engineering consultant of the Pratt & Whitney Gage Division, Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn., while CHARLES A. WHITNEY was made chief engineer in the gage engineering department. Mr. Fox began his career with Pratt & Whitney in 1918 as a draftsman, became a gage engineer in 1928, and chief engineer in the gage engineering department five years later. Mr. Whitney, with the Company since 1937, has been assistant chief engineer for the last eight years.

NEWTON CO., Manchester, Conn., electronics manufacturer, recently purchased the AMERICAN TOOL WORKS OF HARTFORD, INC., Hartford, Conn., the facilities of which will now be removed to Manchester. Among the former officers of the acquired company who are joining Newton are JOHN SUNDKVIST, founder, who will act as consultant; and NORMAN NELSON and EDWARD WILD, who will also continue as sales manager and superintendent of the production department, respectively.

BROWN & SHARPE MFG. CO., Providence, R. I., has announced the formation of three additional divisions in its manufacturing organization at the Promenade St. plant: screw machine division, with A. DEAN HUNTER as division superintendent, Mr. Hunter having formerly been works superintendent; central services division, with FRANK E. MANCHESTER as superintendent; and the foundry division, with FRANK A. BENOIT, JR., as superintendent.

CARROLL L. WILSON has joined the Metals & Controls Corporation, Attleboro, Mass., in the capacity of vice-president and general manager. Mr. Wilson, who has been on the Board of Directors of this concern, was previously director of industrial development of the Climax Molybdenum Co.

FRAZIER O. STRATTON has been named chief engineer of the Sterling Engineering Co., Laconia, N. H., subsidiary of the American Machine & Foundry Co.





(Left to Right) Raymond S. Fox, chief engineering consultant of the Pratt & Whitney Gage Division; and Charles A. Whitney, chief engineer, gage engineering department



Neal L. Cobb, chief engineer of the Fellows Gear Shaper Co.

NEAL L. COBB, chief of tool design at the Fellows Gear Shaper Co., Springfield, Vt., was recently appointed chief engineer.

New York and New Jersey

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., recently opened its new Buffalo branch sales office and warehouse, which is located at 2051 Elmwood Ave., occupying an area of 14,200 square feet. The company has maintained offices in Buffalo for the last sixty years, servicing western and southern New York, as well as part of Pennsylvania. This branch carries a complete line of specialty steels in the area and a full line of Crucible's tool steel, as well as handling sales for the Pittsburgh Crucible Division and the Trent Tube Company.

DR. AUGUSTUS B. KINZEL has been appointed director of research by the Union Carbide and Carbon Corporation, New York City. In his new capacity, he will be responsible for the administration and coordinaton of the research activities of all divisions of Union Carbide. Dr. Kinzel has been actively engaged in research with the Corporation since 1926, when he joined the Electro Metallurgical Co. as a research metallurgist.

H. E. MARTIN is joining the Metal and Thermit Corporation, New York City, as president and a director. Mr. Martin was formerly manager of the New York district of the Babcock & Wilcox Co.

AUSTIN E. FRIBANCE was recently named chief engineer of the Rochester Mfg. Co., Rochester, N. Y.

(*Continued on page* 255)

GET OUR *Free* 6-PAGE FOLDER

See where and how we mass-manufacture Small Gearing to uniformly fine tolerances. This attractively printed 8½ x 11" 6-page folder is punched for ring-binder use. You'll want to keep it handy for frequent reference. It contains 23 pictures of Small Gears, plant views, as well as Diametral and Circular Pitch Tables. Ask for your copy on company stationery, please!



G. S. SMALL GEARS

You'll *never* get stung with poor Gearing when you specify "G.S." For, each succeeding unit, in a run of hundreds or thousands, is made with a degree of accuracy you never thought possible! This extreme precision is the result of thirty-eight years of doing ONE job *better* . . . making Small Gearing *exclusively.*

If you have a Small Gear problem, or use production runs in sizes from 12 to 96 D.P.—shift the responsibility to G.S. You can do that with confidence . . . secure in the knowledge that assembly lines will run smoother. Rejects will no longer cause headaches. And your product will run smoother—quieter—and live longer too!

FRACTIONAL HORSEPOWER GS

GEAR Specialties, Inc.

2635 WEST MEDILL AVENUE
CHICAGO 47, ILLINOIS

SPURS • SPIRALS • HELICALS • BEVELS • INTERNALS
WORM GEARING • RACKS • THREAD GRINDING

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARING

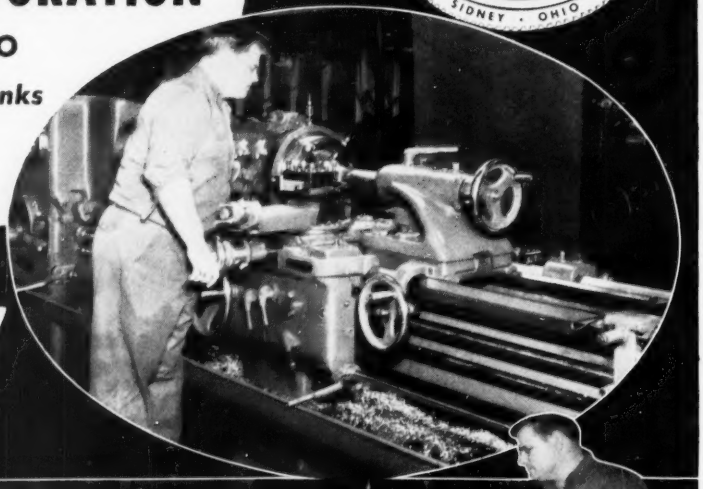
McCAULEY
INDUSTRIAL CORPORATION

DAYTON, OHIO

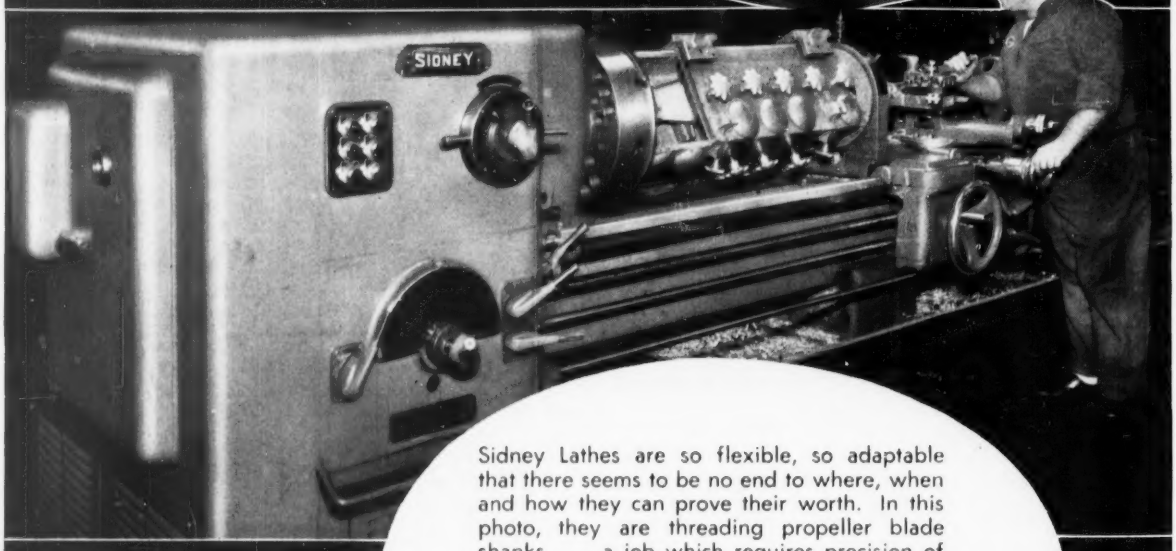
threads propeller blade shanks

with

THE SIDNEY MACHINE TOOL COMPANY
50th Year
of service to
AMERICAN INDUSTRY
1904 · 1954
SIDNEY · OHIO



SIDNEY HEAVY-DUTY LATHES



Sidney Lathes are so flexible, so adaptable that there seems to be no end to where, when and how they can prove their worth. In this photo, they are threading propeller blade shanks . . . a job which requires precision of the highest order . . . running steadily and with satisfactory results.

It's the same story in hundreds of plants . . .

SIDNEY HEAVY-DUTY LATHES
DO MORE JOBS PER HOUR . . .
AT LEAST COST PER JOB

Write for bulletins

Think this over:

Postwar designed machines show more than one-third greater production capacity. Over-age, obsolete machines—more than 1,000,000 of them—are costing more by $1,000,000,000.00 to do the same work as new machines and should be replaced. Replace your obsolete turning-equipment with modern SIDNEY LATHES.

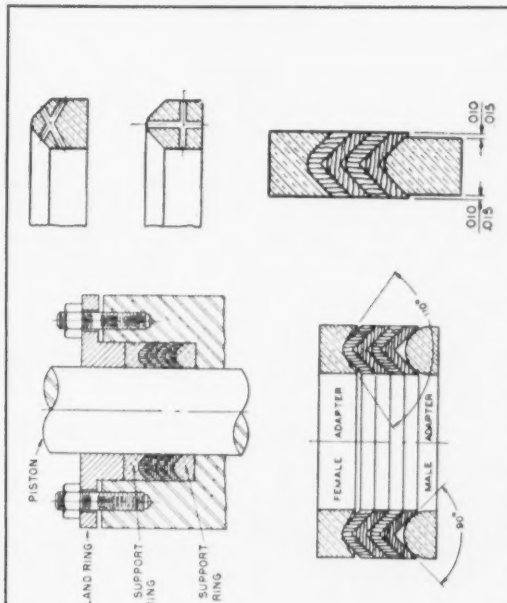
THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904

For more information on products advertised, use Inquiry Card, page 241

MACHINERY'S DATA SHEETS 759 and 760

CLEARANCES FOR LEATHER VEE PACKINGS



Clearances between the male support ring or adapter and the piston or cylinder wall, as well as the included angle of the adapter, are relatively unimportant. Clearances for the female adapter, however, should conform with the recommendations given in Table 1.

Included angles of female adapters may vary from 90 to 120 degrees. For high-pressure applications, the angle should equal that of the packing.

Specially shaped adapters, as shown at lower left, are recommended for applications involving rotating motions and low pressures. Other methods of providing for the entrance of pressure to the vee sealing elements in low-pressure applications are shown at the right.

Table 1. Clearances between Piston and Gland Ring, and Female Adapter and Cylinder Wall for Pressures up to 20,000 Pounds per Square Inch

Plunger Diameter, Inches	1 to 5	6 to 10	12 to 18	20 to 32	36 and Over
Clearance on Diameter, Inch	0.003	0.004	0.005	0.006	0.007

Table 2. Recommended Clearances between Piston and Cylinder for Pressures up to 20,000 Pounds per Square Inch

Plunger Diam., Inches	1 to 3	4 to 7	8 to 10	12 to 18	20 to 24	28 to 36	40 and Over
Clearance on Diam., Inch	0.003	0.004	0.005	0.006	0.008	0.010	0.012

MACHINERY'S Data Sheet No. 759, August, 1954

Compiled by the American Leather Belting Association

PRESSURE IN TONS REQUIRED TO SHEAR AND PUNCH MILD STEEL PLATE

(For Mild Steel Plate Having Shearing Strength of 50,000 Pounds per Square Inch)

Thickness of Metal		SHEARING	PUNCHING							
		Pressure in Tons Required to Shear 1-Inch Length	Diameter of Hole, Inch							
Gage or Size	Inch		1/8	1/4	3/8	1/2	5/8	3/4	7/8	1
20	0.036	0.99	0.35	0.71	1.1	1.4	1.8	2.1	2.5	2.8
18	0.048	1.30	0.47	0.94	1.4	1.9	2.4	2.8	3.3	3.8
16	0.060	1.65	0.59	1.20	1.8	2.4	2.9	3.5	4.1	4.7
14	0.075	2.05	0.74	1.50	2.2	2.9	3.7	4.4	5.2	5.9
12	0.105	2.85	1.00	2.10	3.1	4.1	5.2	6.2	7.2	8.3
11	0.120	3.25	1.20	2.40	3.5	4.7	5.9	7.1	8.3	9.4
10	0.135	3.65	....	2.70	4.0	5.3	6.6	8.0	9.3	10.6
3/16	0.187	5.01	....	3.70	5.5	7.4	9.2	11.1	12.9	14.8
1/4	0.250	6.60	....	4.90	7.4	9.8	12.3	14.8	17.2	19.7
3/8	0.375	9.55	....	....	11.1	14.8	18.5	22.1	25.8	29.5
1/2	0.500	12.50	....	....	....	19.7	24.6	29.5	34.4	39.4
5/8	0.625	15.75	....	....	....	....	30.8	36.9	43.0	49.2
3/4	0.750	18.75	....	....	....	....	....	44.3	51.7	59.0
1	1.000	25.00	....	....	....	....	....	....	....	80.0

To determine pressure in tons required to shear steel, multiply length in inches of piece to be sheared by figure in third column opposite thickness of metal.

Tonnage may be reduced up to 50 per cent by providing proper shear in die.

To determine tons of pressure required to punch a given number of holes, multiply number of holes by figure shown in chart for hole size and metal thickness.

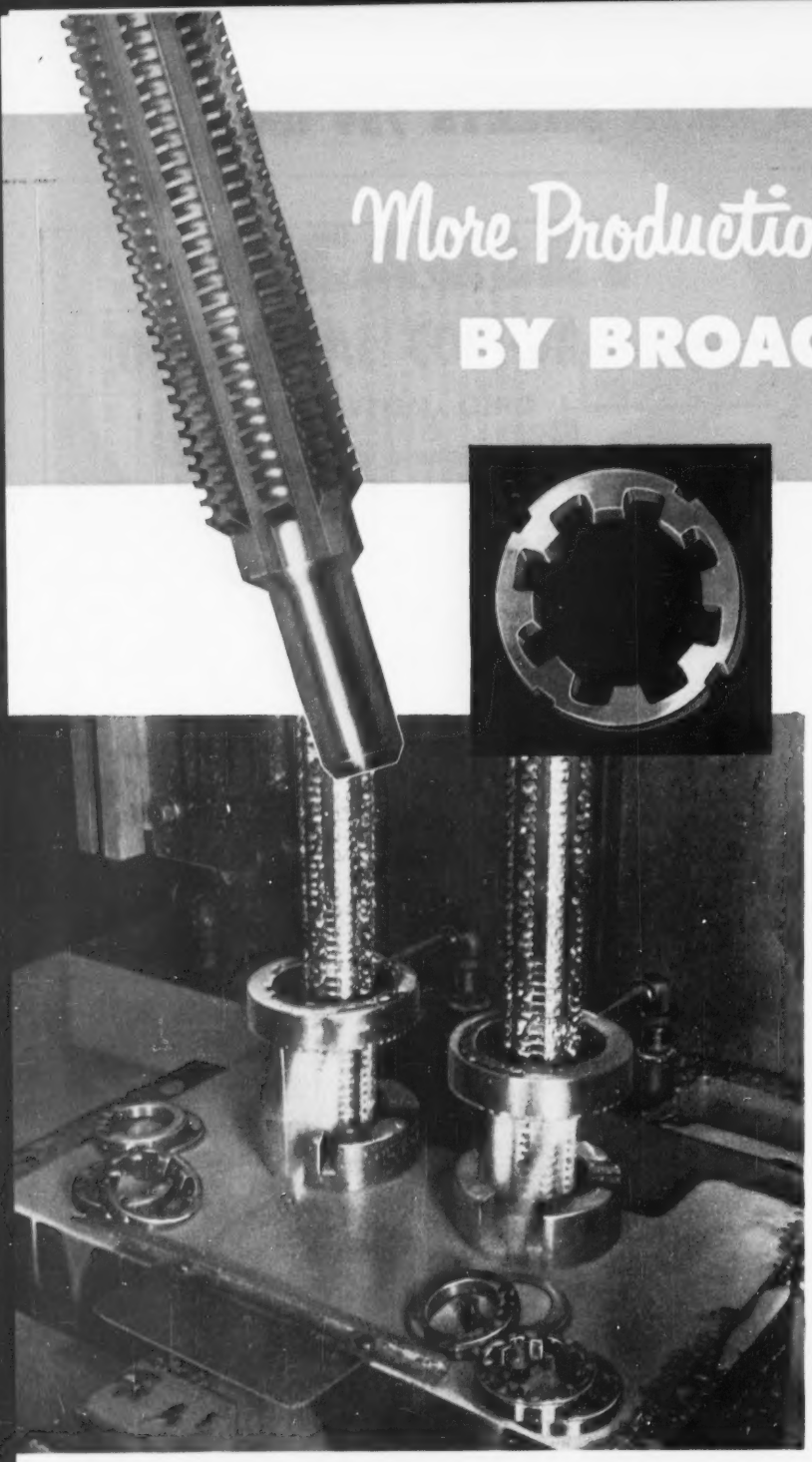
To reduce tonnage 50 per cent, stagger punches one metal thickness.

For smooth operation, do not exceed two-thirds of the rated capacity of the machine.

MACHINERY'S Data Sheet No. 760, August, 1954

Compiled by Verson Allsteel Press Co., Chicago, Illinois

More Production, More Profit BY BROACHING . . .



Internal broaching of a cam ring. The spline form has unsymmetrical sides and cam form on the major diameter. The steel is soft and tends to tear, yet this Continental Broach sizes the I.D. and cuts 8 splines 5/16" deep *in one pass.*

REMOVE STOCK TO PRECISION LIMITS FAST . . . ROUGH AND FINISH IN ONE PASS!

The scope of Broaching has broadened in recent years. Many broaching operations do precision work in far less time than other metal-cutting methods.

Continental Engineers have for years been designing all types of cutting tools, broaches and broaching fixtures. They can recommend the most economical way to do your work.

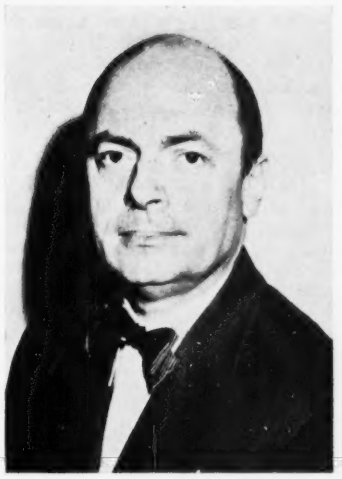
For facts about increasing your production by broaching, call in your local Ex-Cell-O representative—or write Continental in Detroit for Cutting Tool Catalog.

CTW

Continental TOOL WORKS

DIVISION OF EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

4-15





(Left to Right) Egon E. Rassow, who becomes president of the newly incorporated firm of K. R. Wilson, Inc.; and Frank C. Wilson, chairman of the board and director of engineering

K. R. WILSON, INC., recently filed incorporation papers, having previously contracted for the purchase of the machine tool and special automotive service tool business founded by the late Kirke R. Wilson in Arcade, N. Y. Since his death in 1948, the business had been operated by executors of the K. R. Wilson estate. The firm's administrative and sales offices, formerly at 215 Main St., Buffalo, N. Y., will be transferred to the modern plant of the concern at Arcade. Officers and directors of the new corporation are as follows: EGON E. RASSOW, president; FRANK C. WILSON, chairman of the board and director of engineering; and MANLY FLEISCHMANN, secretary. Two other directors will be ANSON F. SHERMAN and JAMES GORDON DEVIN.

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., has established a Tool Steel Research Division within the sales department. The Division will be located at the Sanderson-Halcomb Works, Syracuse, N. Y., which is the company's tool steel manufacturing center, with M. E. CUMMINGS as head. Mr. Cummings resigned his duties as assistant vice-president of operations to take over the directorship of this activity. Other members of the research staff are ROBERT F. SPILLETT, J. ROBERT RICHARDS, and ROBERT B. GANLEY.

COFFMAN & MURRAY, INC., have been appointed a representative in western New York State by the Brad Foote Gear Works, Inc., Cicero, Ill. The representative, which is located at 4025 Bailey Ave., Buffalo, N. Y., succeeds Gibney & Coffman.

PAUL H. TAYLOR has been elected a director and vice-president in charge of the Research and Hydra Spring Divisions of the Wales-Strippit Corporation, North Tonawanda, N. Y. Mr. Taylor joined the Corporation in 1945 and since that time has been director of patent and research.

WILLIAM E. WARD, vice-president and general manager of the Russell, Burdsall & Ward Bolt and Nut Co., Port Chester, N. Y., has been elected president and general manager, assuming the post formerly held by EVANS WARD, president of the company since 1933. Mr. Ward now becomes chairman of the board of directors and chief executive officer. SAMUEL N. COMLY, who was vice-president and treasurer, has been elected executive vice-president, while JOHN B. GATES, assistant treasurer, has been promoted to treasurer

KENNETH SLAWSON has been made vice-president of the Ford Instrument Co., Division of the Sperry Corporation, Long Island City, N. Y.

WALTER H. RILEY has been named regional sales manager for the Elastic Stop Nut Corporation of America, Union, N. J. His territory includes Michigan, Wisconsin, and Minnesota, with headquarters in the New Center Bldg., Detroit. Mr. Riley was formerly in the Minnesota-Wisconsin sales area. ROBERT E. JONES has now been assigned to Wisconsin. KENNETH D. DAVIS, who was Chicago district manager, has been named regional sales manager there, his territory including Illinois, Iowa, Nebraska, Indiana, and Kentucky. JACK RICHARDS will now be district manager in Chicago, the post formerly held by Mr. Davis.

CARL W. KALCHTHALER has been named chief engineer for the Hyatt Bearings Division, Harrison, N. J., of the General Motors Corporation succeeding H. RALSTON GIBBONS who was chief engineer for the last four years. Mr. Gibbons has become technical assistant to the general manager. He has been with the Division since 1922, and M. Kalchthaler since 1925.

P. L. CODDINGTON has been appointed manager of the Alloy Tube Division, Union, N. J., of the Carpenter Steel Co., Reading, Pa. Mr. Coddington was previously assistant to the president at the Division.

Ohio

WILLIAM IRRGANG was recently elected president and general manager of the Lincoln Electric Co., Cleveland, Ohio, manufacturer of arc-welding equipment. Mr. Irrgang,



William E. Ward, new president and general manager of Russell, Burdsall & Ward Bolt and Nut Co.



William Irrgang, newly elected president and general manager of the Lincoln Electric Co.

who was executive vice-president since 1951, becomes the third president in the company's fifty nine-year history. He has been with Lincoln since 1929, engaged in various phases of plant operation, engineering, and management. JAMES F. LINCOLN, who was president, was elected chairman of the board, and will remain active in the direction of company policies. JOHN C. LINCOLN, founder of the company, now living in Phoenix, Ariz., was elected honorary chairman of the board and treasurer. Also announced at this time was the election of the following officers: JOHN S. ROSCOE, executive vice-president; A. F. DAVIS, vice-president and secretary; and GEORGE LANDIS, vice-president.

RICHARD J. RAND was recently named manager of the Cincinnati, Ohio, sales office by the Crucible Steel Company of America, Pittsburgh, Pa. Mr. Rand, who has been with Crucible since 1940, replaces H. E. FRIEDLEIN, who will act as special sales representative and consultant. Mr. Friedlein has been associated with the company for some forty-five years, the last nineteen as manager of the Cincinnati branch.

REPUBLIC STEEL CORPORATION, Cleveland, Ohio, has established a new division to coordinate sales of high-strength steels, to be known as the Hi Strength Steel Division. EDWARD K. WALDSCHMIDT, who was formerly associated with the Jones & Laughlin Steel Corporation, has been appointed manager of sales for the Division.

CINCINNATI SHAPER CO., Cincinnati, Ohio, announces the following promotions: FRANK PFEFFERLE, special projects manager; ALFRED BAUMGARTNER, sales manager; and JOSEPH WARREN, advertising manager. Mr. Pfefferle's new duties will involve special work in the fields of new product development and market research.



Lester M. Cole, general sales manager of Warner & Swasey Co.

LESTER M. COLE has become general sales manager of the Warner & Swasey Co., Cleveland, Ohio. Mr. Cole started with the company as a tool designer, and later entered sales work, establishing the Houston district office. He has been southern district manager since 1946.

DONALD M. PATTISON, vice-president in charge of sales for the last seven years at the Warner & Swasey Co., Cleveland, Ohio, recently retired. With his two sons now out of college, Mr. Pattison intends to found or buy into some small manufacturing company or sales agency.

TIMKEN ROLLER BEARING CO., Canton, Ohio, announces the promotion of the following men: HERCHEL M. RICHEY, factory manager of the Bearing and Rock Bit Divisions, has been named general factory manager; HENRY A. TOBEY, general superintendent of the Canton Bearing Division, has been promoted to factory manager of the Canton and Gambrinus bearing factories; and WILBUR L. YOUNG, assistant chief inspector, has been appointed general superintendent of the Canton Bearing Division, the post formerly held by Mr. Tobey.

DENISON ENGINEERING CO., Columbus, Ohio, recently established an Aircraft Products Division, which will sell, service, and manufacture such products as the Denison variable-volume aircraft pump, surge pumping valve, and aircraft fluid motor and relief valve. EDWIN L. SHAW has been appointed head of the Division; ROLAND N. CROSSLEY, director of sales; and JAMES PARR, chief engineer.

AL E. KNAZEK has joined the Threadwell Tap & Die Co., Greenfield, Mass., in the capacity of district sales and service manager for the Cleveland, Akron, and Canton, Ohio, and Erie, Pa., areas.

JACK G. ALLEN was recently elected president, general manager, and a director of the Artisan Metal Works Co., Cleveland, Ohio.

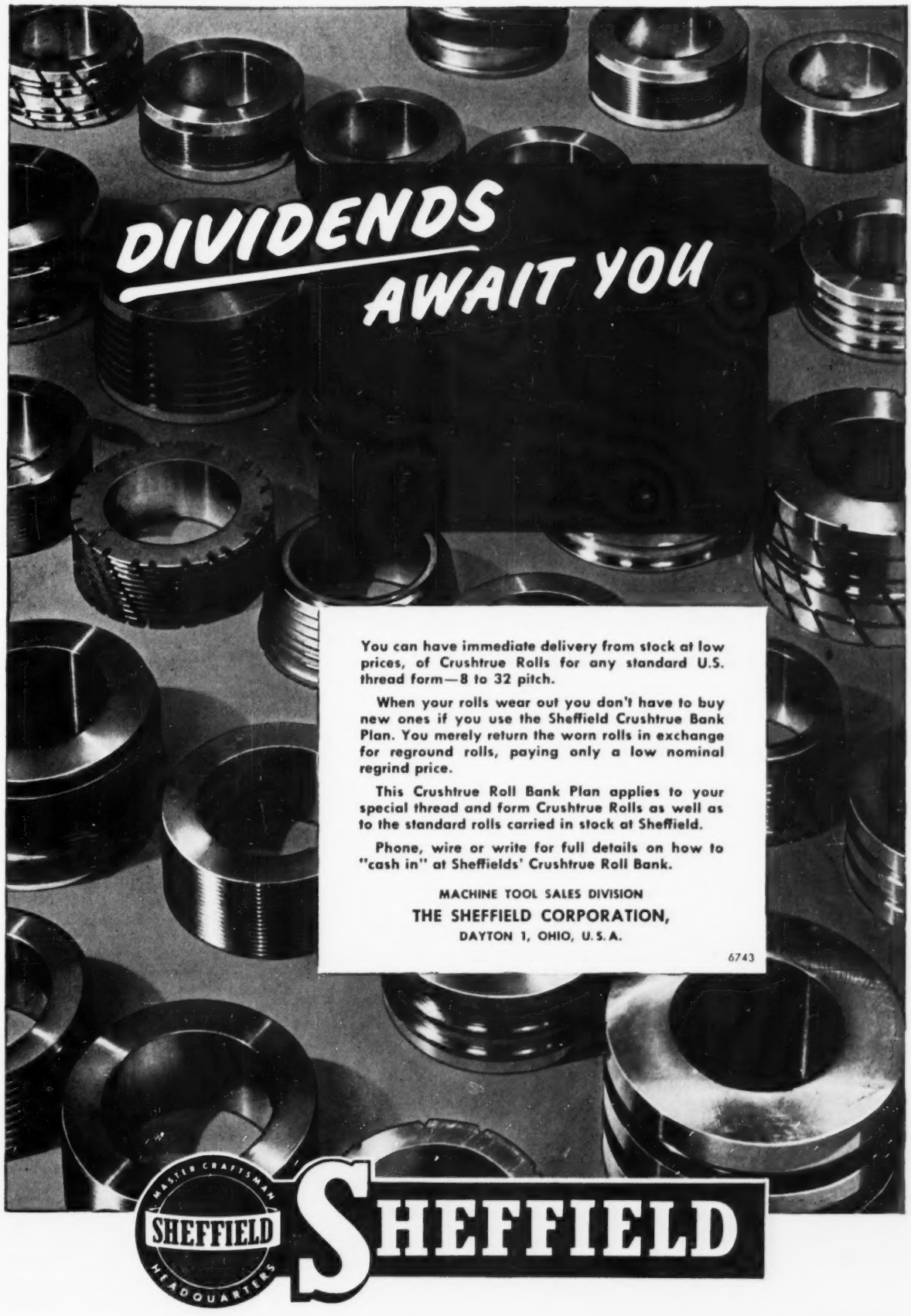
Pennsylvania

E. T. WALTON, formerly chief metallurgist of the Midland, Pa., Works of the Crucible Steel Company of America, has been appointed metallurgical engineer in the central offices at Pittsburgh. J. D. DICKERSON is now chief metallurgist of the Midland Works, assuming Mr. Walton's previous duties. Also announced was the appointment of CHARLES W. SCHOTT as plant metallurgist at Midland. He was formerly with the United States Steel Corporation, where he was supervisor of quality surveys.

DR. CARL B. POST, chief metallurgist at the Carpenter Steel Co., Reading, Pa., was recently named head of the metallurgical and research de-



Albert E. Henn (center), fifty years with the National Acme Co., Cleveland, Ohio, received a diamond-studded pin from company president F. H. Chapin (right) as C. W. Simpson (left), executive vice-president assisted at the ceremony. Mr. Henn, who is sales manager, held various positions with the company until 1936 when he became machinery sales manager. His father, E. C. Henn, co-inventor in 1894 of the first successful multiple-spindle automatic turret lathe, was one of the founders of the National Acme Mfg. Co.


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You can have immediate delivery from stock at low prices, of Crushtrue Rolls for any standard U.S. thread form—8 to 32 pitch.
When your rolls wear out you don't have to buy new ones if you use the Sheffield Crushtrue Bank Plan. You merely return the worn rolls in exchange for reground rolls, paying only a low nominal regrind price.
This Crushtrue Roll Bank Plan applies to your special thread and form Crushtrue Rolls as well as to the standard rolls carried in stock at Sheffield.
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HEADQUARTERS
SHEFFIELD



(Left to Right) Dr. Carl B. Post, head of the metallurgical and research departments of Carpenter Steel Co.; George V. Luerssen, retiring vice-president in charge of metallurgy

partments. At the same time, GEORGE V. LUERSSEN, vice-president in charge of metallurgy, retired after forty-seven years of service with the company. Dr. Post, a member of the metallurgical staff since 1938, was chief metallurgist since 1951. Last year, he received the Bradley Stoughton plaque, an award presented by the Lehigh Valley Section of the American Society for Metals. Mr. Luerssen was the first man to receive the award in 1945.

FIRTH STERLING, INC., Pittsburgh, Pa., recently announced three promotions in the Carbide Division: M. L. BACKSTROM who was chief engineer, has been promoted to assistant sales manager; W. E. MONTGOMERY has succeeded Mr. Backstrom as chief engineer; and JOHN GABRENAS has been named assistant chief engineer. Announced for the company's field engineering service was the addition of four carbide engineers: W. R. SUTTON, Detroit; J. F. KROEGER, Los Angeles; J. J. JOURNEYCAKE, Houston; and JAMES L. ZIMMERMAN, Chicago, with headquarters at Melrose Park, Ill.

C. I. BRADFORD, vice-president and director of operations for Rem-Cru Titanium, Inc., Midland, Pa., was recently appointed president and a member of the Board. WALTER U. REISINGER, who was president and a member of the Board is retiring. R. S. POISTER, vice-president of the Crucible Steel Company of America, was elected chairman of the board of Rem-Cru, succeeding WILLIAM H. COLVIN, who also retired.

J. N. JONES has been appointed engineering and service manager at Salt Lake City, Utah, by the Westinghouse Electric Corporation, Pittsburgh, Pa. Mr. Jones was formerly a Pacific Coast region electrical superintendent. He now replaces EDWARD H. HULSE, who has been transferred to East Pittsburgh, where he will be mining, petroleum, and chemical section manager in the industry engineering department.

PHILLIP C. ALTHEN has been appointed head of the newly created packaging section of the sales development division of the Aluminum Company of America, Pittsburgh, Pa. Assisting Mr. Althen will be RICHARD C. MANCHESTER and ROBERT H. TOOKER, formerly of the New York and Atlanta offices, respectively.

J. S. ROLLER, assistant general sales manager of Firth Sterling, Inc., Pittsburgh, Pa., was recently promoted to general sales manager.



J. S. Roller, general sales manager of Firth Sterling, Inc.

Mr. Roller joined the company in 1951 as vice-president and general manager of the Method X Co., a Firth Sterling affiliate. Prior to that, he was associated with the Republic Steel Corporation for fifteen years.

L. J. ROHL has been appointed to the newly created position of chief metallurgical engineer of the United States Steel Corporation, Pittsburgh, Pa. In this capacity, Mr. Rohl will coordinate the metallurgical activities of all divisions of United States Steel. He was formerly chief metallurgical engineer, operations—steel, this post now being filled by R. W. SIMON.

J. B. HENRY, JR., has been appointed manager of the new Architectural Division of the Allegheny Ludlum Steel Corporation. This Division was recently established because of increasing use of stainless steel as a building material. Mr. Henry will have his headquarters at the company's general offices in Brackenridge, Pa.

FOXBORO CO., Foxboro, Mass., announces that its new 15,000-square foot plant being constructed at 2270 Noblestown Road, Pittsburgh, Pa., is scheduled for completion by August 1. The company manufactures instruments for the measurement and control of industrial process variables.

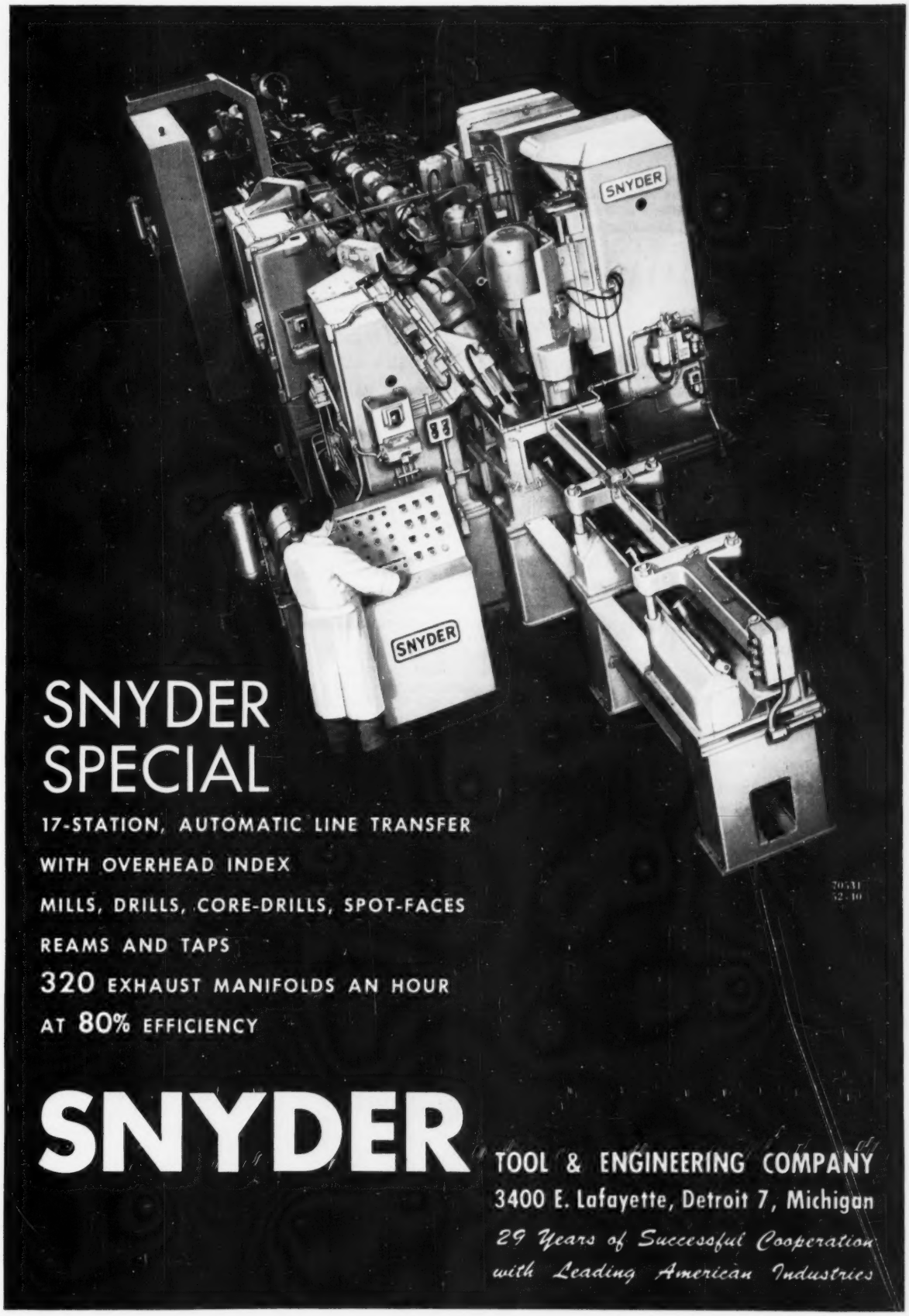
SAMUEL J. LOMBARDO was recently named a sales engineer in the Philadelphia, Pa., district office of the E. W. Bliss Co., Canton, Ohio, manufacturer of mechanical and hydraulic presses, rolling mills, and canmaking machinery. Before joining Bliss, Mr. Lombardo was associated with the H. K. Porter Co.

W. BECKHARDT has been named technical service representative in the Norristown, Pa., area for Oakite Products, Inc., New York City, manufacturers of industrial cleaning and metal-treating materials. Mr. Beckhardt was formerly with the Eastern Tank Maintenance Co. of Philadelphia.

HARRY R. MEYER has been named manager of sales for the By-Products and Lukenweld Divisions of the Lukens Steel Co., Coatesville, Pa. Mr. Meyer has been with the Lukens sales organization for thirty-five years.

NORMAN B. OBBARD has been appointed president of the American Bridge Division, Pittsburgh, Pa., of the United States Steel Corporation. Mr. Obbard will succeed FRANK K. MCDANEL, who is retiring.

HOWARD H. CASEY has been appointed director of engineering by the Midvale Co., Philadelphia, Pa. He was formerly general sales manager for the concern.



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WITH OVERHEAD INDEX
MILLS, DRILLS, CORE-DRILLS, SPOT-FACES
REAMS AND TAPS
320 EXHAUST MANIFOLDS AN HOUR
AT 80% EFFICIENCY

SNYDER

TOOL & ENGINEERING COMPANY
3400 E. Lafayette, Detroit 7, Michigan
29 Years of Successful Cooperation with Leading American Industries

FRANK W. LADKY has been appointed assistant to the president of the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Mr. Ladky was formerly district sales manager in Milwaukee, Wis., a position which is being filled by the appointment of DAVID L. GARLICK.

JOHN HENRY ZURN has been appointed vice-president—sales, of the J. A. Zurn Mfg. Co., Erie, Pa. ALBERT A. BAKER has been named sales administrator.

Texas, Oklahoma, and Kansas

SKEE TOOL CO., San Antonio, Tex., recently purchased the Anthony Tool Co., and will now manufacture the line of Anthony cut-off tools.

ROBERT A. MONAGUE has become a field engineer for the Denison Engineering Co., Columbus, Ohio, at the Tulsa, Okla., office.

FAIRBANKS, MORSE & CO., Chicago, Ill., recently opened its new pump plant at Kansas City, Kans., on a 38 1/2-acre site.

Washington, D. C.; Maryland; and Alabama

BALDWIN-LIMA-HAMILTON CORPORATION, Philadelphia, Pa., recently acquired the O. S. PETERS CO., Washington, D. C., manufacturer of devices for materials testing equipment and electronic specialties.

BLACK & DECKER MFG. CO., Towson, Md., has announced the election of the following officers: ADAM QUICK, vice-president—production; J. F. SPAULDING, vice-president and general sales manager; and R. G. HORNER, vice-president—sales planning. Mr. Quick, who joined the company in 1935 in the manufacturing division, was formerly assistant to the vice-president in charge of manufacturing. Both Mr. Horner and Mr. Spaulding have been with the company for many years in various sales capacities.



Photo by Udel Bros.

Adam Quick, who has been elected vice-president — production, of Black & Decker Mfg. Co.

REYNOLDS METALS CO., Louisville, Ky., announces a $2,585,000 program to expand its aluminum sheet mill facilities at Sheffield, Ala., the plant there being operated by the Reynolds Alloys Co., a subsidiary.

Wisconsin, Illinois, and Minnesota

DONALD M. LAFLIN, vice-president in charge of sales for the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., was elected a vice-president of Amertool Services, Inc., at the annual Amertool meeting in Mexico City. The latter concern, composed of fifteen machine tool builder companies, provides engineering and machine tool application service to manufacturers in Japan, Mexico, South America, and Germany.

JONES & LAMSON MACHINE TOOL CO., Springfield, Vt., announces the appointment of the RICKERT INDUSTRIAL SUPPLY CO., 614 W. Michigan St., Milwaukee, Wis., as distributor of Jones & Lamson automatic opening die-heads, chasers, and fixtures. The distributor will cover eastern Wisconsin and northern Michigan.

HENRY & WRIGHT, DIVISION EMHART MFG. CO., Hartford, Conn., recently appointed the BRYANT MACHINERY CO. as midwest sales representative. The latter company, with headquarters at 640 West Washington Blvd., Chicago, Ill. and 647 W. Virginia St., Milwaukee, Wis. Bryant will represent Henry & Wright in Iowa, most of Wisconsin, northern Illinois, and northern Indiana. B. B. PATTON, who is the Chicago factory representative for Henry & Wright, will work with the new sales representatives, using Bryant's Chicago office as headquarters.

GEORGE SAUM has been appointed manager of the Aircraft Products Division of the Taylor Forge & Pipe Works, Chicago, Ill. T. E. MARSTON has become general sales manager in the Division.

D. F. MCCANDLISH, manager of the Chicago, Ill., district office of the Air Reduction Sales Co., New York City, was recently promoted to manager of the North Central region which has its headquarters in Chicago. Mr. McCandlish succeeds S. H. NEWBURN, who was recently made president of Air Reduction Canada Ltd. S. S. BRUCE, JR., succeeds Mr. McCandlish at Chicago.

MERLYN E. SCHLENKER has been appointed to the Chicago sales engineering staff of the Reliance Electric & Engineering Co., Cleveland, Ohio, manufacturer of electric motors and motor drives.

R. K. LEBLOND MACHINE TOOL CO., Cincinnati, Ohio, announces that its Chicago district office has moved from 20 N. Wacker Drive to 6429 W. North Ave., Oak Park, Ill.

RICHARD D. O'BRIEN has been elected secretary of the Pressed Steel Car Co., Inc., Chicago, Ill.

DAYTON ROGERS MFG. CO., Minneapolis, Minn., announces the appointment of the following sales engineers: WILLIAM H. POWELL, in the upper northern section of New York State, with headquarters at 49 Dorchester Road, Rochester, N. Y.; D. R. PENNINGTON, Commonwealth Sales Co., 214 Park Place, McKnight Village, Pittsburgh, Pa., for western Pennsylvania; and OSCAR HOOD for Texas and Oklahoma, with headquarters at 3321 Fairfield Ave., Fort Worth, Tex.

Coming Events

SEPTEMBER 14-23—FOURTH EUROPEAN MACHINE TOOL EXPOSITION to be held in Milan, Italy, promoted by the European Committee for Cooperation of Machine Tool Industries. For further information write to the Committee, care of Unione Costruttori Italiani Macchine Utensili, Via Domodossola, Milan, Italy.

SEPTEMBER 21-23—Annual meeting and exhibition of the SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS in conjunction with the First International Instrument Congress and Exposition, to be held at the Bellevue-Stratford Hotel, Philadelphia, Pa. Write to the general chairman, Frank G. Tatnall, Box 4034, Chestnut Hill, Philadelphia 18, Pa.

SEPTEMBER 28-OCTOBER 1—Twenty-eighth Iron and Steel Exposition and Annual Convention of the ASSOCIATION OF IRON AND STEEL ENGINEERS to be held at the Public Auditorium, Cleveland, Ohio. T. J. Ess, managing director, 1010 Empire Bldg., Pittsburgh 22, Pa.

OCTOBER 1-2—Annual meeting of the STANDARDS ENGINEERS SOCIETY at Haddon Hall, Atlantic City, N.J. Secretary, F. M. Oberlander, Box 281, Camden, N. J.

OCTOBER 14-15—TENTH ANNUAL NATIONAL CONFERENCE ON INDUS-

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Undivided Responsibility

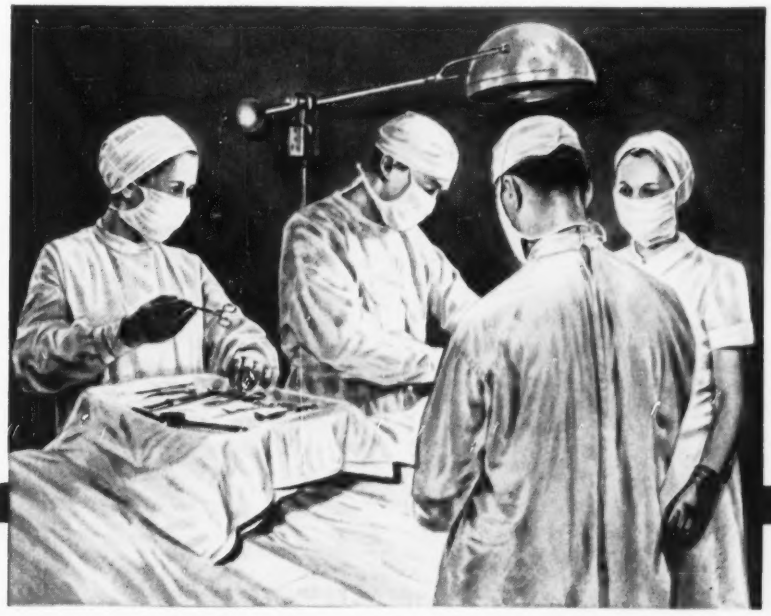
From the time the surgeon grasps the scalpel until the last stitch closes the incision, he alone has complete responsibility for the success of the operation . . . and often the life of the patient. Because of the surgeon's specialized knowledge, no patient would think of having it otherwise.

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

For more information on products advertised, use Inquiry Card, page 241

TRIAL HYDRAULICS to be held at the Sheraton Hotel, Chicago, Ill. For further information, write to the Illinois Institute of Technology, 35 W. 33rd St., Chicago 16, Ill.

OCTOBER 21-23—Eighth New England Conference of the AMERICAN SOCIETY FOR QUALITY CONTROL at the Ten Eyck Hotel, Albany, N. Y. For additional information, write to Southern Connecticut Section, A.S.Q.C., Box 1681, Bridgeport 1, Conn.

OCTOBER 24-27 — Semi-annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION, at the Edgewater Beach Hotel, Chicago, Ill. Executive secretary, John C. Sears, One Thomas Circle, Washington 5, D. C.

OCTOBER 25-27—Machine Tool Conference of the AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS at the Statler Hotel, Detroit, Mich. For further information, contact the Institute, 33 W. 39th St., New York 18, N. Y.

NOVEMBER 1-5—Thirty-sixth National Metal Exposition sponsored by the AMERICAN SOCIETY FOR METALS at the International Amphitheatre, Chicago, Ill. Secretary, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

NOVEMBER 29-DECEMBER 2—First INTERNATIONAL AUTOMATION EXPOSITION to be held at the 244th Regiment Armory, New York City. For further information, write to Exposition, 845 Ridge Ave., Pittsburgh 12, Pa.

DECEMBER 2-7—Twenty-first National Exposition of Power and Mechanical Engineering under the auspices of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS, at the Commercial Museum, Philadelphia, Pa. Manager, Charles F. Roth, 480 Lexington Ave., New York 17, N. Y.

* * *

Gisholt Announces Machine Tool Rental Plan

The Gisholt Machine Co., Madison, Wis., announces a plan for the leasing of machine tools. Three choices are available, each based on a seven-year lease agreement. Each may be written either with or without the option to purchase. The right to terminate the agreement at the end of one, two, or three years depends on the plan selected. The lease may also be written with the option of purchase.

This plan is designed to cover standard machines, including the required electrical equipment. Certain accessories and all tooling must be purchased outright. Special-purpose machines can be leased from the company by arrangement.

Obituaries

SHERMAN R. LATHROP, service representative of the Onsrud Macaine Works, Inc., Chicago, Ill., died suddenly of a heart attack on July 5 in London, England, at the age of fifty-seven years. Mr. Lathrop had just completed a business tour of various manufacturers in Sweden, France, and England, setting up machines for them. He was born in Council Bluffs, Iowa. Prior to his association with Onsrud, he was with the Hack Mfg. Co. as a shop foreman. Mr. Lathrop became affiliated with Onsrud in 1942, and worked through the entire shop, from his original position of machine assembler to that of service representative for this machine tool concern.

LEON H. JOHNSON, chief engineer of the Warren Division of the Struthers Wells Corporation, Warren, Pa., died on June 8 at the age of sixty-nine years. Mr. Johnson held several patents for chemical processing equipment. He was a member of the American Society of Mechanical Engineers, American Welding Society, and American Society for Testing Materials.

HUGO F. HOESTERMAN, vice-president of the Kickhaefer Mfg. Co., Milwaukee, Wis., died on June 24.

New Books and Publications

THOMAS' REGISTER OF AMERICAN MANUFACTURERS (1954). 9100 pages, 9 by 14 inches. Published by the Thomas Publishing Co., 461 Eighth Ave., New York 1, N. Y. Price $15, (upon renewal, $12.50).

More than 80,000 products, covering all lines of manufacture in the United States, are classified in the forty-fourth edition of this informative purchasing encyclopedia, which is now published in a new four-volume format. The separate index, or finding list, thus becomes Vol. V.

The first three volumes list the names and addresses of manufacturers classified by products. The products are classified not only by generalized group names but by specific types, so that the prospective buyer can easily find the particular type that will meet his requirements. The names of the manufacturers under each product classification are arranged by states and cities, thus making it easy for a buyer to select a product within certain geographical boundaries if desired. All classifications are thoroughly cross-indexed. A capacity or capital investment rating is given for each firm at each product listing.

The fourth volume contains an alphabetical list of manufacturers with branches, subsidiaries, and other data such as names of company officials and cable codes. It also gives an alphabetical list of trade names, together with export and other miscellaneous information.

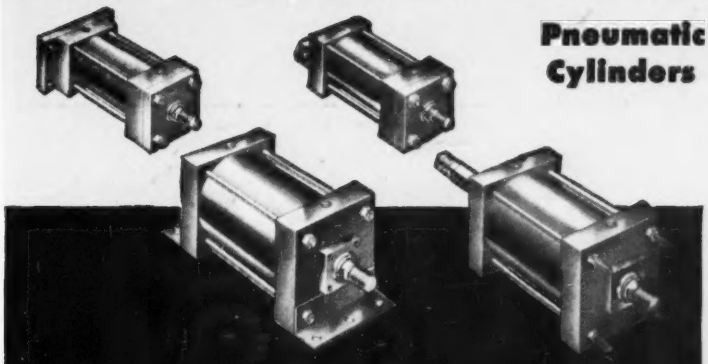
Buyers, sales managers, research departments, production executives, and all those who require a list of products or names of manufacturers for various purposes will find this "where to buy" source invaluable.

RESIDUAL STRESSES IN METALS AND METAL CONSTRUCTION. Edited by William R. Osgood. 363 pages, 6 1/4 by 9 inches. Published by the Reinhold Publishing Corporation, 330 W. 42nd St., New York 36, N. Y. Price, $10.

This book, prepared under the guidance of the Committee on Residual Stresses of the National Academy of Sciences, National Research Council, evaluates the effects of residual stresses upon the performance of various kinds of structures. It consists of twenty-two papers contributed by specialists in the field from both here and abroad. In addition, a summary was prepared by the Committee covering many aspects of the residual stress problem. To mention the titles of some of the papers—Residual Stresses in Welding; Influence of Residual Stresses on the Behavior of Ductile Structures; Microstresses Originated by Gas Inclusions; Effect of Residual Stresses on High-Speed Impact Resistance; Correlation of Residual Stresses with Fatigue Strength of Machine Elements and Related Phenomena; Effect of Residual Stresses on the Failure of Engineering Materials; and Complete Determination of the State of Residual Stress in Solid and Hollow Metal Cylinders.

CAMS—DESIGN AND LAY-OUT. By Louis Kasper. 101 pages, 5 by 8 inches. Published by the Chemical Publishing Co., Inc., 212 Fifth Ave., New York 10, N. Y. Price, $3.50.

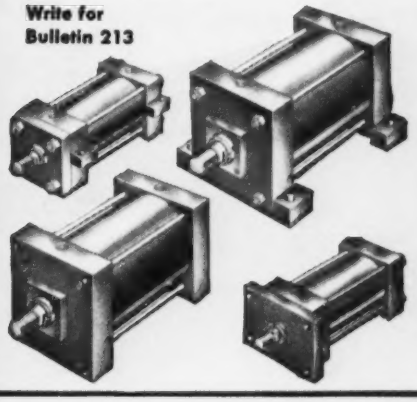
This book is based on the practical and extended experience of the author in cam design. The examples of design and lay-out are selected with care to cover all those cases which occur frequently in industrial uses of cams. There are eighty-four original illustrations. The chapter headings are as follows: Types of Cams; Cam Design and Lay-out; Reciprocating Cams; Rotating Cams; Cylindrical Cams; Wiper Cams, Rocker Cams, and Rolling Levers; Rectangular-Motion Cams; Sleeve Cams; Miscellaneous Cam Applications; and Computation.



Pneumatic Cylinders

Hannifin Series "A" Square Type Pneumatic Cylinders are made in 11 bore sizes from 1½" to 14"...are available with 13 standard mountings, many combination mountings. All tooling is to extremely close tolerances to insure accurate, easy mounting. Cylinders are micro-honed and piston rods are ground and polished. Heavy-duty tie rods. Exclusive bronze cartridge gland is easily removed without dismantling the entire cylinder.

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NOW...

HANNIFIN HAS THE MOST COMPLETE LINE OF AIR CONTROL EQUIPMENT!

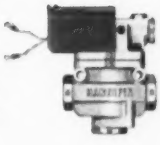
NEW! REVOLUTIONARY HANNIFIN *P-M Pilot-Master Valves*

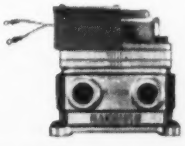
Piston-operated poppet design. Exclusive replaceable cartridge for easier maintenance. Speeds to 600 cycles per minute. Pressure from 15 to 150 p.s.i. Integral, solenoid-controlled pilot heads or a choice of 10 separate pilot valves for remote control.

- Fewer Valves to Stock
- Fewer Parts to Stock
- Maximum Interchangeability
- No Springs in Main Valve

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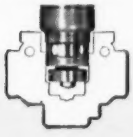
2 and 3-Way Valves.
Same valve operates 2-way or 3-way, normally open or normally closed. ⅜" to 1¼" I.P.S.



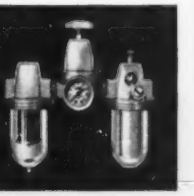


4-Way Valves.
Two 3-way valves mounted in compact, common body. Two piston poppets. Two cartridges. ⅜", ½", ¾" I.P.S.

EXCLUSIVE REPLACEABLE CARTRIDGE



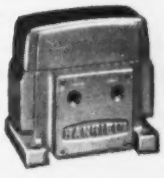
AIR WARDEN
Air filters, pressure regulators and lubricators to protect air operated equipment. Bulletin 1010B.



Disc Type Air Control Valves

Designed for smooth, positive and accurate control of air-operated equipment. Bronze discs lapped to perfect seal with seats. Packless design. For hand, foot or electrical operation. Sizes: ⅛" to 1¼" I.P.S.

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Hannifin "Directair" electrically controlled air-operated disc valve



Foot-operated treadle valve (Also spring return and rotary types)



Standard hand control valve (Single or duplex)

HANNIFIN

Hannifin Corporation, 1109 S. Kilbourn Ave., Chicago 24, Ill.

Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

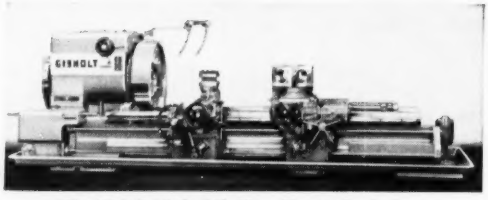


"Here's why GISHOLT insists upon the HEAVIEST CASTINGS!"

Look at them . . . castings for the heaviest saddle type turret lathes in the business! Look at all the angles:

First, note how the headstock is cast integrally with the bed for perfect spindle alignment . . . how cross supports give the most solid base for carriages, tools and slides . . . how extra-heavy webbing gives the headstock the ruggedness to support powerful gear train members.

Remember, too, that cast iron absorbs vibration. The heavier the better! And Gisholt controls the quality of the finest nickel semi-steel in its own foundry.



The Gisholt 5L Saddle Type Turret Lathe has a net weight of 22,500 lb. without equipment.

What does it mean to you? You can load up your Gisholts with carbides and really turn out the chips! You've got the strength, the rigidity and the freedom from vibration to take all the speed you can get from today's carbides—with the heaviest feeds—and still have the safety margin to take care of tomorrow's tool bit developments.

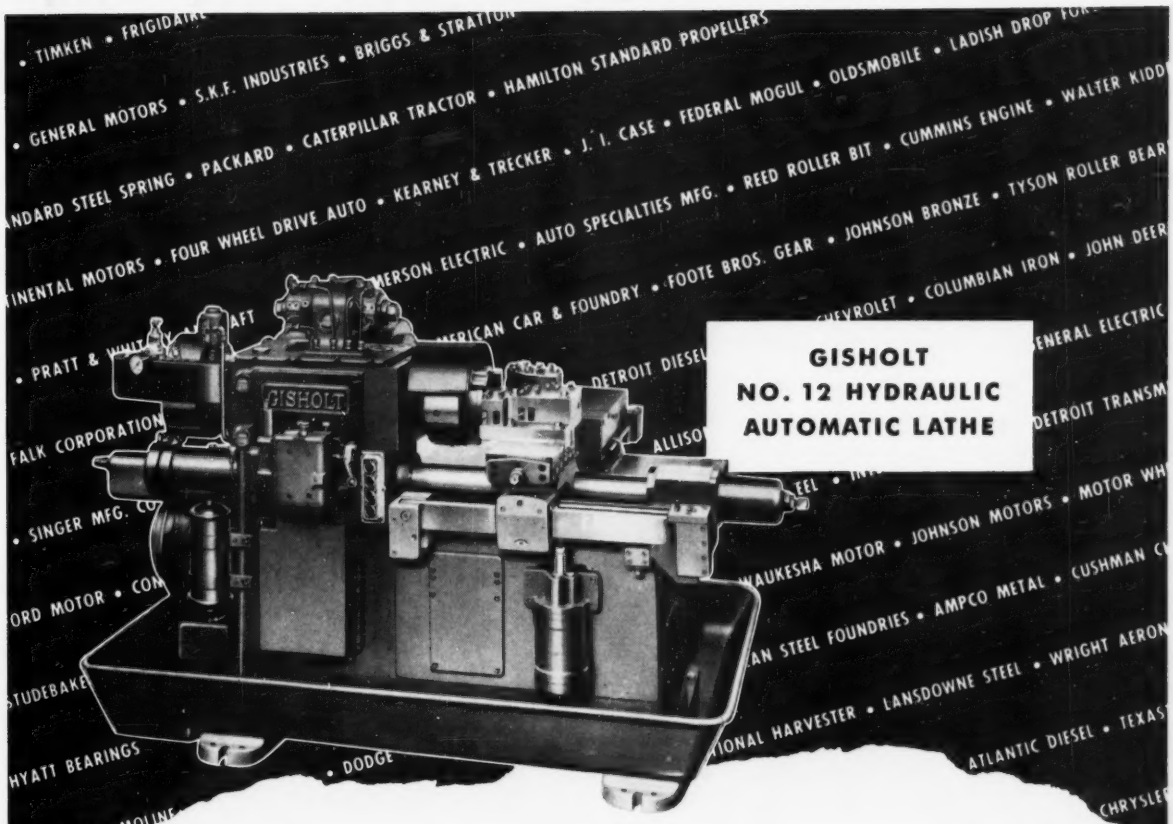
GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.



TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

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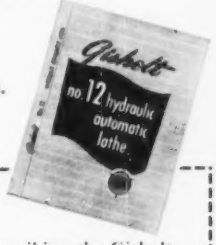
What makes this machine so popular?

It's the simple basic application of hydraulic principles—perfected through the years. It's a single spindle machine that handles all classes of work—holding with a chuck or an arbor, with fixtures, or with a work driver for between centers. Front carriage alone will perform 14 different cycles. Independent rear slide can be positioned at any angle to the work. Feeds are infinitely adjustable...not limited by cams. Here's the versatility, the speed, the automatic cycle, and the easy change-over that mean big savings for scores of users. Why not for you?

If you have parts up to 12″ to produce at lower cost, look at the Gisholt No. 12 Hydraulic Automatic Lathe. Call your Gisholt representative. Or write us.

This new catalog will show you why.

All operating features are clearly described, fully illustrated. Here, too, are 28 different jobs to show many classes of work and tooling possibilities. Write for your copy.



THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES
SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Gisholt Machine Company
Madison 10, Wisconsin

Please send my copy of the catalog describing the Gisholt No. 12 Hydraulic Automatic Lathe.

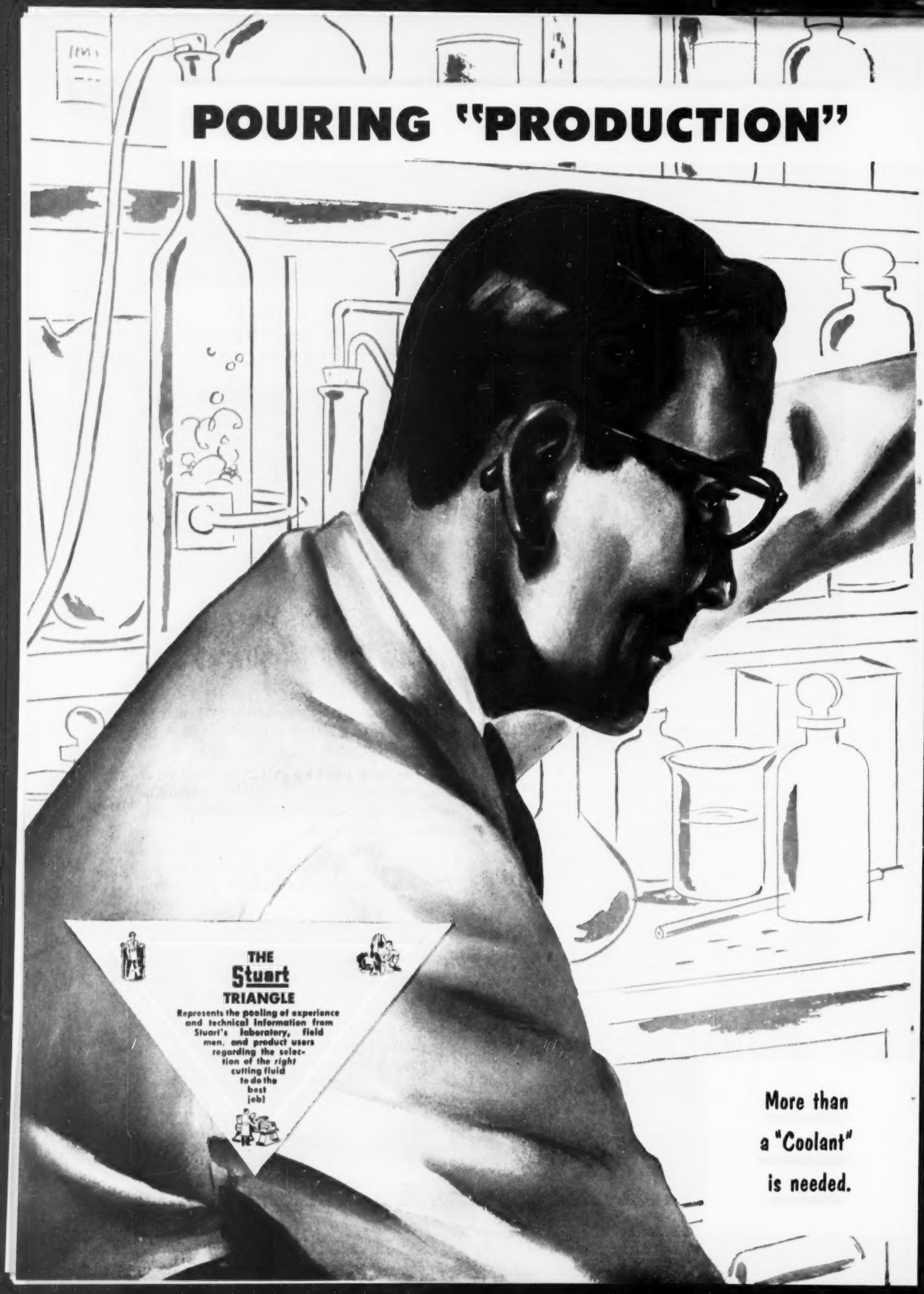
Name.....*Title*.....

Company.....

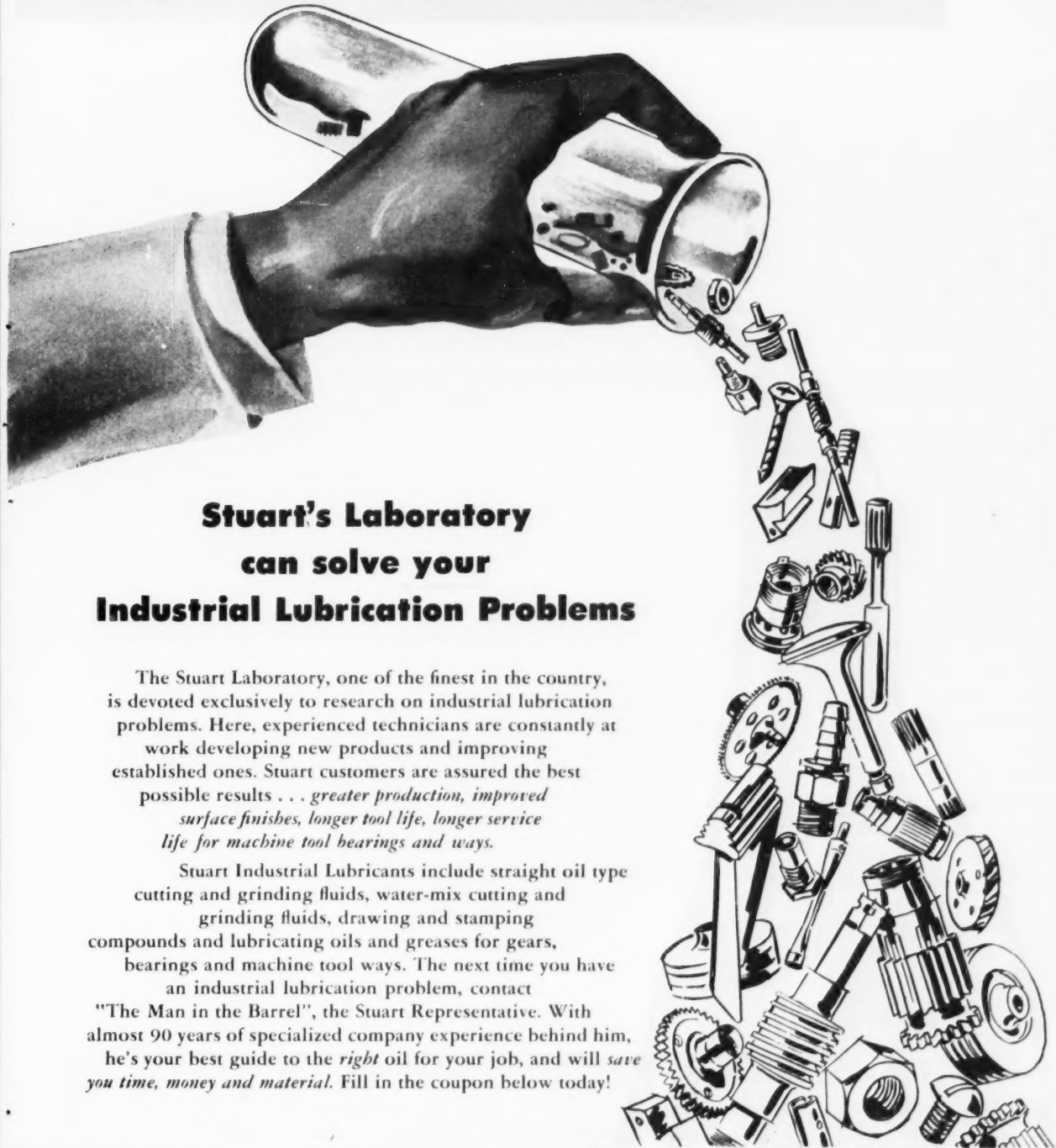
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The Stuart Laboratory, one of the finest in the country, is devoted exclusively to research on industrial lubrication problems. Here, experienced technicians are constantly at work developing new products and improving established ones. Stuart customers are assured the best possible results . . . *greater production, improved surface finishes, longer tool life, longer service life for machine tool bearings and ways.*

Stuart Industrial Lubricants include straight oil type cutting and grinding fluids, water-mix cutting and grinding fluids, drawing and stamping compounds and lubricating oils and greases for gears, bearings and machine tool ways. The next time you have an industrial lubrication problem, contact "The Man in the Barrel", the Stuart Representative. With almost 90 years of specialized company experience behind him, he's your best guide to the *right* oil for your job, and will *save you time, money and material.* Fill in the coupon below today!

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TIME-TESTED CUTTING FLUIDS AND LUBRICANTS

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☐ Please have Stuart Representative call.

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Are Your Fasteners HEADED FOR TROUBLE?

Screws are sometimes like people. If they "lose their heads" under pressure — if they turn out to be "softies" — if they don't "square up," they are *headed for trouble*. It takes only a few "bad" screws on the line each day to erase most planned assembly savings.

That is why quality standards for P-K Self-tapping Screws were set so *high* when they were first introduced by Parker-Kalon. Today, with even *higher standards* they continue to take top honors for dependability, despite many efforts to match them.

The difference between screws made to P-K standards and those that are "headed for trouble" are hard to see at a glance, but the effects of screw failure (parts spoilage, high reclamation costs) are quickly evident in mounting assembly costs.

P-K Self-tapping Screws are "headed for savings"—not only headed, but threaded, pointed, and heat-treated with the same purpose, to keep your assembly lines trouble-free. That's why so many more manufacturers of America's best known products specify P-K. For information on any fastening problem, talk to a P-K Assembly Engineer. Or write: Parker-Kalon Division, General American Transportation Corporation, 202 Varick St., New York 14.



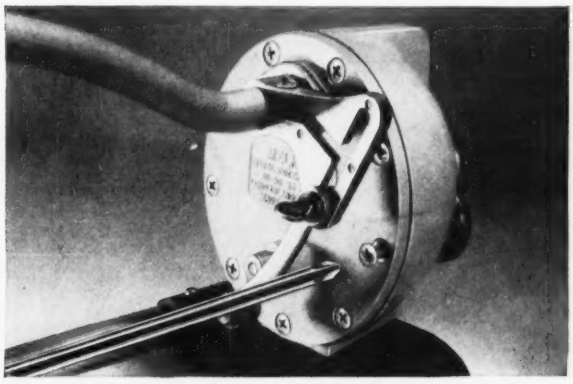
P-K STANDARDS protect you against these and many other symptoms of Screws "headed for trouble". They don't "get by" P-K inspectors — that's why *all* P-K Self-tapping Screws can be "Guaranteed First Quality."

PARKER-KALON

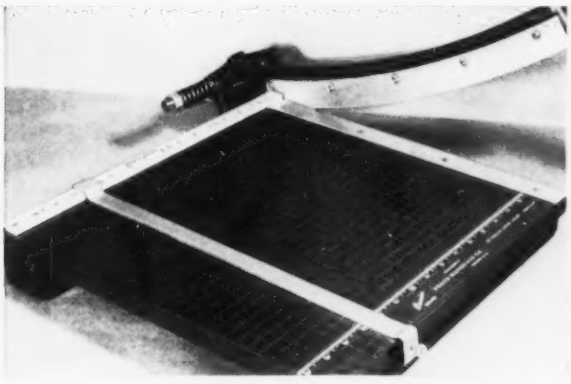


IN STOCK ...see your nearby P-K Distributor...

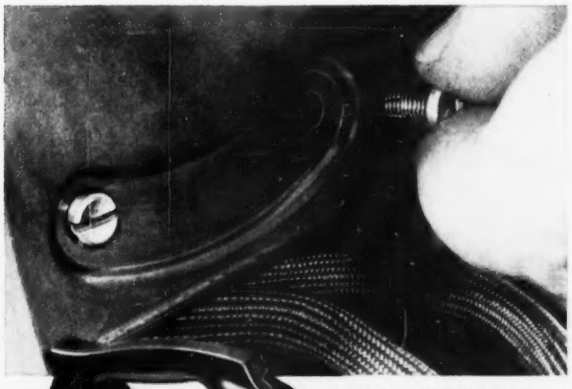
"SWINGIN' SPRAY," MELNOR Products Co.'s popular lawn sprinkler keeps on "swinging" because the oscillating mechanism is separate and sealed from the water intake system. To assure equally dependable assembly strength resistant to the roughest handling, Melnor fastens zinc and aluminum parts with P-K Screws, 7 Phillips Head Type Z and 18 Type F, driven with air tools.



IN THE PREMIER CUTTING BOARD, made by Photo Materials Co., when 21 P-K Type A replaced wood screws to fasten the ruler, straight blade, bearing casting, and bottom cleats to the hard maple board, pilot holes were eliminated. The 5 P-K Type F Screws that now fasten curved blade to cast iron handle ended tapping. Power driving further speeds assembly.



with P-K quality—planned assembly savings pay off







HOOVER SMOOTHED OUT trouble and speeded assembly of this Steam or Dry Iron by switching to P-K Self-tapping Screws for seven fastenings previously made with machine screws. Tapping and lock washers were eliminated. The assembly is made stronger than ever, with an important saving in time. Five P-K Type F Screws fasten the phenol formaldehyde handle to the sole plate cover (left). On the assembly line, these screws are power driven. One P-K Type F Screw fastens the steam valve control support bracket to the die-cast aluminum filler tube at the front of the iron (not shown). One P-K Type A Screw fastens the heel closure plate to the terminal bracket (right).

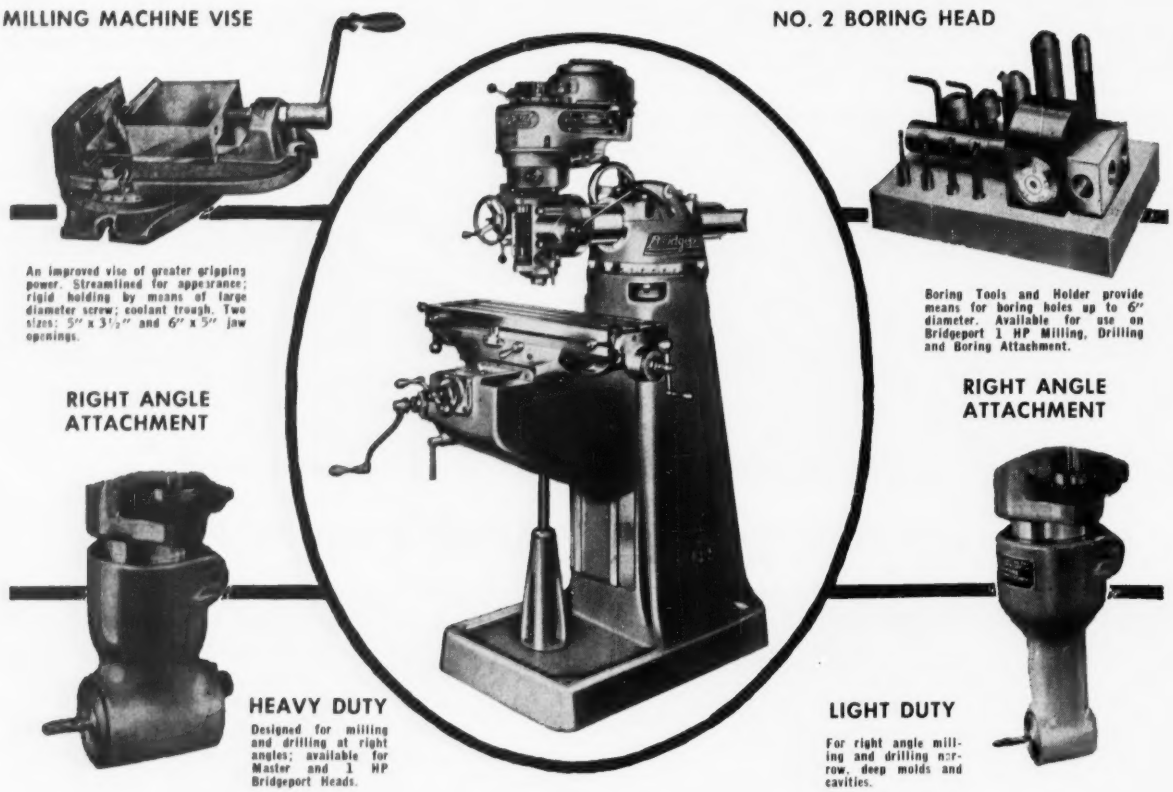
The Original

SELF-TAPPING SCREWS





your local Supply and Service Specialist



Defer obsolescence for many years to come... with

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▼ TURRET MILLING MACHINES ▼

Shops both large and small, by replacing old, inefficient machines with modern "BRIDGEPORT MILLERS" find prompt returns on their investment. Moderately priced, versatile, accurate "BRIDGEPORTS" put obsolescence far off into the distant future because they are away ahead of their time in convenience, long-lived economy and outstanding utility.

These universally-accepted machines are kept constantly busy production-wise through their *exclusive method* of milling, drilling, boring and shaping, combined with ability to position the milling head at all angles over a wide area *without changing set up.*

Attachments are available (some of which are shown here) extending the utility of these machines of unprecedented popularity.

Ask your dealer—or us—to show how the Bridgeport Turret Milling Machine will defer obsolescence in your shop. Literature available on request.

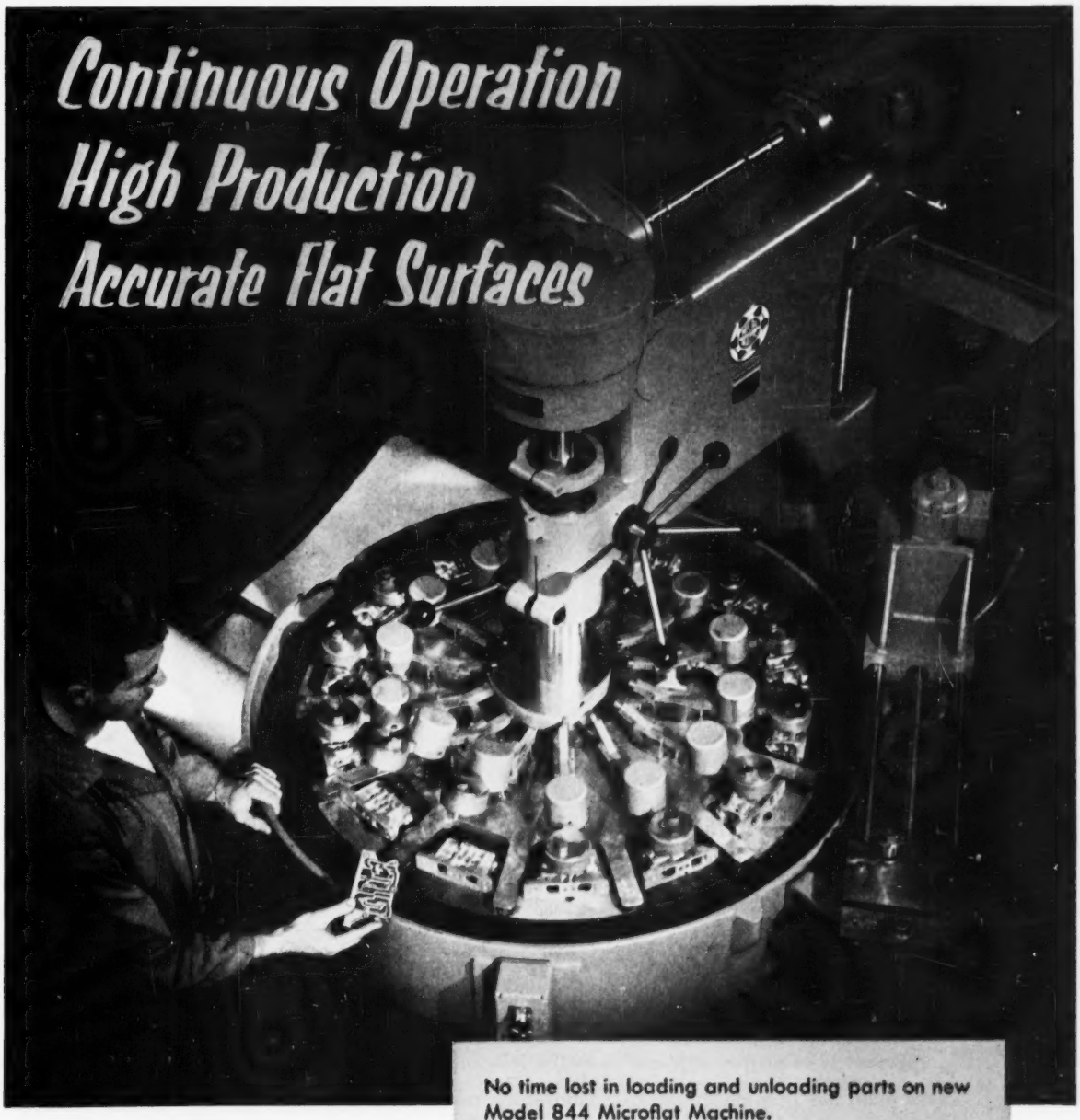
Bridgeport MACHINES, INC.

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

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Continuous Operation High Production Accurate Flat Surfaces



No time lost in loading and unloading parts on new Model 844 Microflat Machine.

New type multiple-station, self-actuated fixture and more selective controls give this machine a production capacity of a finished part every 3 seconds.

For complete description of this new Microflat Machine write for CROSS-HATCH, Vol. 6, No. 1.

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Tidewater Supply Co., Charlotte 4, North Carolina

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Our plant has become the forging laboratory, our engineering department the forging encyclopedia and our organization the forging consultants for industry.

Our leadership as pioneers of forging methods and applications establishes our ability to help you best.

When you come to NATIONAL, this service is yours.

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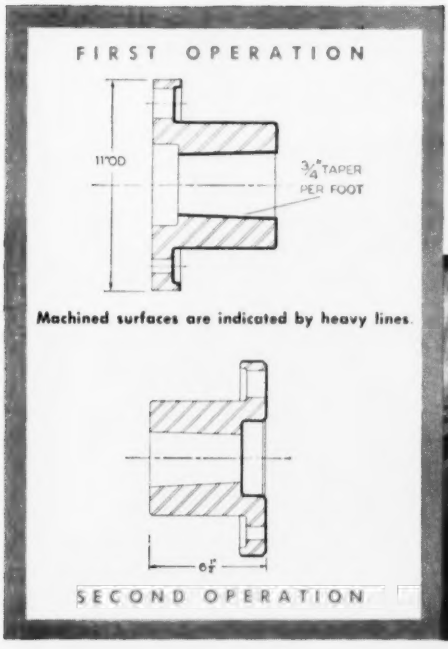
DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS • BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS

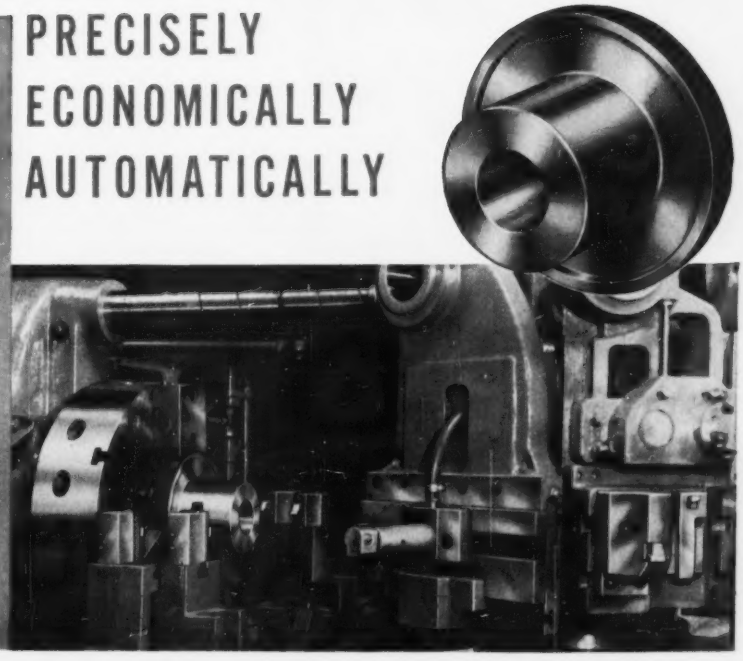
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How to TAME a TOUGH FORGING

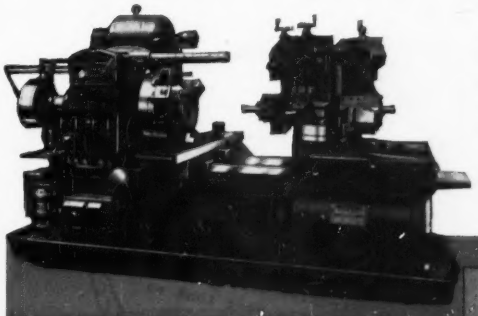
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Use the POTTER & JOHNSTON 6-DRE POWER-FLEX
AUTOMATIC TURRET LATHE

This 11" diameter steel forging required power to drill the 3" diameter hole through from the solid and to remove stock rapidly for final precision size turning. The P & J 6 DRE finished the piece in two operations, performing the machining of the tapered bore by using a single-point slide tool. The most effective speeds and feeds for each operation were preselected and automatically repeated. An automatic air-operated chuck increased output with less operator fatigue. More machines were handled by each man.



This is a typical example of the way P & J Tooling has helped others, and can help you take full advantage of the profitable productive rates possible with this automatic. Let us be on your side working for profits. Send for your copy of Bulletin 128, or call your nearest Pratt and Whitney branch office. Tooling recommendations and production estimates will be yours at no obligation.

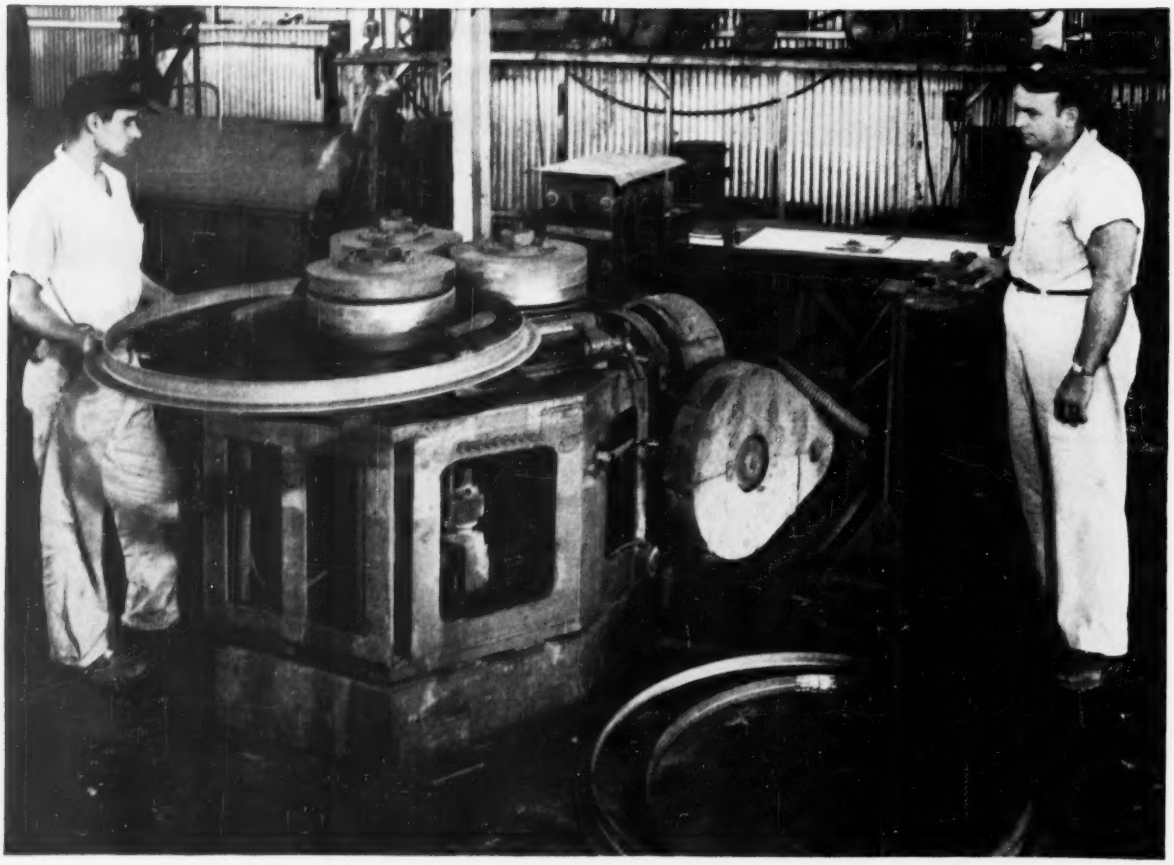
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"Buffalo" No. 2 Bending Roll turning out angle rings at Bushnell Steel Works, Tampa, Fla.

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If you've had to turn away or job out metal bending business, why not do as Bushnell Steel Works and hundreds of other top-notch shops have done—put a high-production "Buffalo" Bending Roll on the job. These easy-to-operate machines are rolling out commercially perfect circles, spirals, arcs and other curved shapes from almost every type of structural—even the tricky leg-in angle bending—faster and cheaper than by any other method. There is a bending roll for your requirements whether for light or heavy work. Write for Bulletins 3344-A and 352-B, and look into this profitable way of bending.



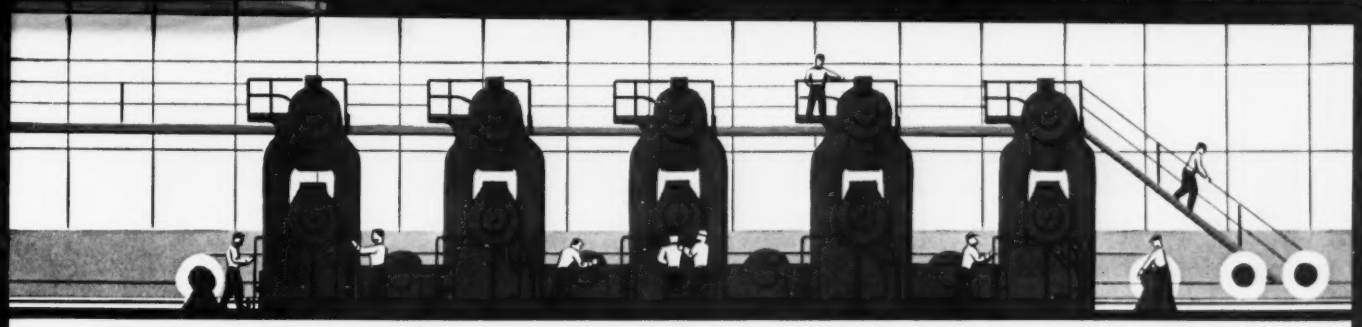
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DRILLING PUNCHING SHEARING BENDING



Now! cut application costs and grease inventories with

NEW STANOLITH GREASE MP

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Here is a newly formulated grease with such an increase in multi-purpose range that it helps you *cut application costs* and *reduce grease inventories.* Higher oil viscosity and greater extreme pressure properties make it suited for wide use in steel mills, cement mills, rubber mills, mining operations—all other heavy equipment industries.

More than just an "E. P." grease, New STANOLITH MP has all of the outstanding properties of STANOLITH greases: excellent oxidation stability and good mechanical stability. It has extreme water resistance and withstands high temperatures—*it will not thin out.* For better protection of all kinds of heavy equipment, under a wide range of conditions, use STANOLITH Grease MP.



New STANOLITH Grease MP takes its place with famous STANOLITH Greases No. 42 and No. 57 to give you the most versatile collection of multi-purpose greases in modern industry.

STANDARD OIL COMPANY *(Indiana)*

Call your nearby Standard Oil lubrication specialist and let him show you how Standard's "multi-purpose" greases can save you money and help you avoid trouble.

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To find headings easily, look for capital letters at top of each page to denote locations.

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Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVES
See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

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DESIGN





Write for our latest bulletin that shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS, with diagrams of unique applications, capacity tables, dimensions and specifications.

ROCKFORD CLUTCHES are thoroughly tested to make sure they will stand up under full torque, shock-load, engagement frequency and duration, slippage and reversals, to help insure more work-time, with less down-time from machines in which they are used. Because of this exacting to-the-job-application, down-time for clutch adjustments or repairs has been reduced to a minimum. Let ROCKFORD engineers help get more work-time for your machines.

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BORG-WARNER
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Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburg, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York 1, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

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American Brass Co., 25 Broadway, New York.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ALLOYS, Zinc
New Jersey Zinc Co., 160 Front St., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor

ARBORS AND MANDRELS
Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
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Brown & Sharpe Mfg. Co., Providence, R. I.
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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.

(*Continued on page* 278)



The Geargrind Universal Oscillating Grinder will perform a wide range of grinding operations. Its initial cost is much lower than would be expected for a grinder with so many specialized uses.

Now...For toolroom or production work —a really versatile and rugged universal grinder

The Geargrind Universal Oscillating Grinder for Fine Finishing of Spherical–Conical –Cylindrical Surfaces

Whether you need tool room accuracy or production economy, you'll save time and money with the versatile Geargrind Universal Oscillating Grinder.

With its various simplified attachments, it is designed to perform *all* of these precision grinding jobs:

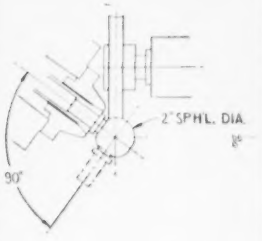
- internal and external cylindrical surfaces
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- external conical surfaces
- internal tapers
- ball bearing races and fillets

YOU'LL WANT ALL THE FACTS

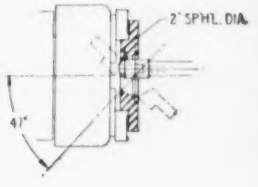


We have prepared a comprehensive 6-page catalog on all the information and specifications of this unique grinder. Please write—we'll be happy to send it to you, along with a quotation of Geargrind's new low prices.

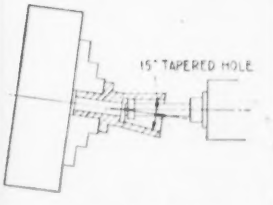
Typical examples of work performed on the Geargrind Universal Precision Grinder



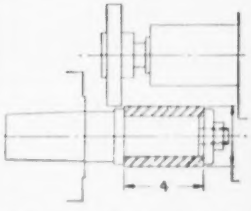
Ball stud, alloy steel, carburized and hardened. Held in a collet.



Flanged ball socket, cast iron. Held in a diaphragm chuck.



Grinding wheel adapter. Grinding the tapered hole. Held in a precision 4-jaw chuck.



External cylindrical grinding.

GEARGRIND Detroit

THE GEAR GRINDING MACHINE CO.
3921 Christopher
Detroit 11, Michigan

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—wherever temperature limit indication is required



CPI PLUGSTATS provide precise thermal warning without calibration drift. Small physical size has been combined with rugged construction. Special alloy contacts assure clean make-and-break. Capable of 200°F overshoot from high or low normal setting. Available also with AN connector. Rated at ¼ ampere, 28 volts, AC or DC resistive loads. Contacts NO or NC. Weight approx 1.5oz

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Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

BABBITT

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

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Casa Corp., 405 Lexington Ave., New York 17.
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Keller Tool Co., Grand Haven, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Olsen, Tinius, Testing Machine Co., Philadelphia, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mich. Tool Co., 2531 11th St., Rockford, Ill.

BALLS

Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
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BARS, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., (Cold Drawn), Republic Bldg., Cleveland, Ohio.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

BEARINGS, Babbitt

Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Ball

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Torrington Co., Torrington, Conn.

(*Continued on page* 280)

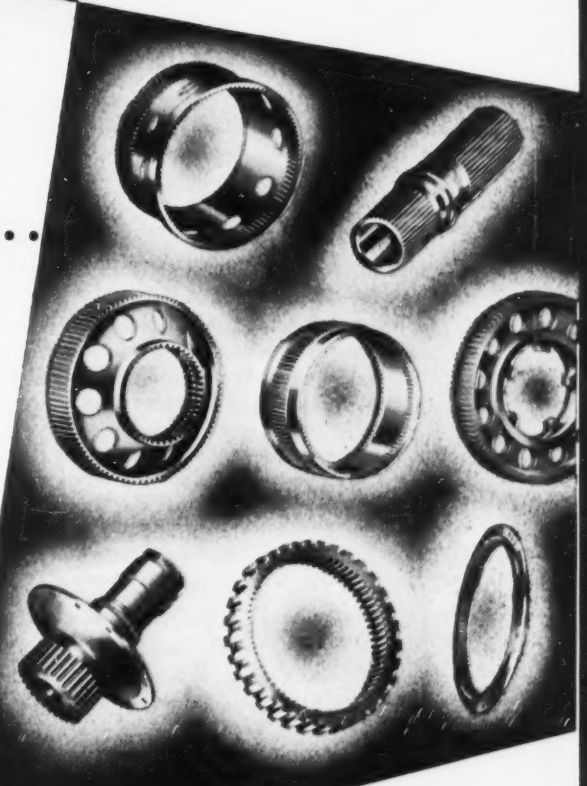
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Range: 36 inches O.D. blank down to a fraction of an inch. Maximum capacity between centers: 80 inches. Special machines have been built to handle diameters up to 6 feet. Shown above is External Geargrind Machine, model GG10X48A.

Speed and Versatility

for Formgrinding Parts Like These . .



Actual operating experience shows: these automatic Geargrind Machines will equal or exceed the continuous production rate of other similar-purpose machines. And, they will do a greater variety of work: aircraft, automotive, machinery, etc.

Gears, splines, and specially contoured parts of all kinds are turned out quickly, accurately on versatile Geargrind Machines.

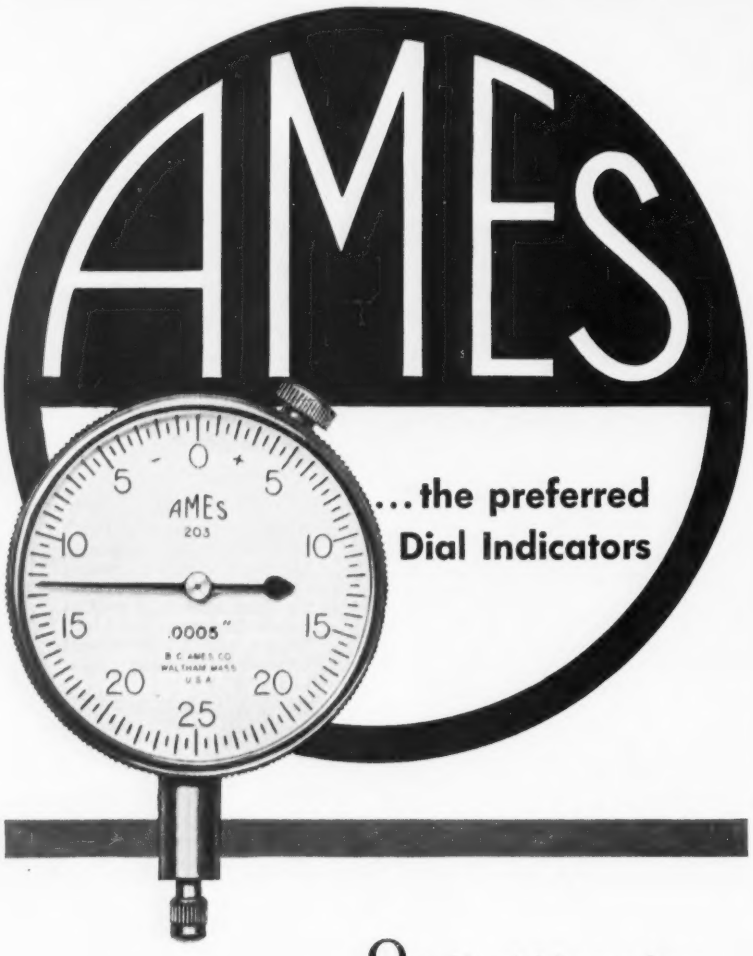


The complete line of machines pioneered and developed over 45 years by Geargrind is described and illustrated in the new 8-page catalog. It's yours for the asking—write on your company letterhead, please.

GEARGRIND
Detroit

ND on
Geargrind Automatics

THE GEAR GRINDING MACHINE CO.
3921 CHRISTOPHER, DETROIT 11, MICHIGAN



One of America's largest and most famous mass-producers recently chose Ames as preferred source of supply for indicator gauges.

The reasons behind this decision are the very reasons why *you* should standardize on Ames dial indicators and dial gauges:—the Ames "Hundred Series" indicators available in four sizes, fit every measuring requirement; they are *accurate, sensitive,* low in friction, yet are *rugged* and *tough*—give *more* on-the-job time. All Ames products embody latest design and highest-quality materials; they are manufactured by methods and machines that are *exclusive* with B. C. Ames Co.



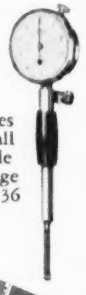
Ames Dial Depth Gauge No. 11C



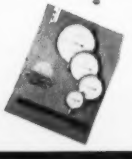
Ames Dial Micrometer No. 517

Ames Amplifying Dial Comparator No. 26





Ames Small Hole Gauge No. 36



Send today for your free copy of Catalog No. 58

Representatives in principal cities. B. C. AMES CO. *27 Ames Street Waltham 54, Mass.*

Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators

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Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

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Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Orange Roller Bearing Co., Inc., Orange, N. J.
Torrington Co., Torrington, Conn.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., Harrison, N. J.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
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BEARINGS, Tapered Roller
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

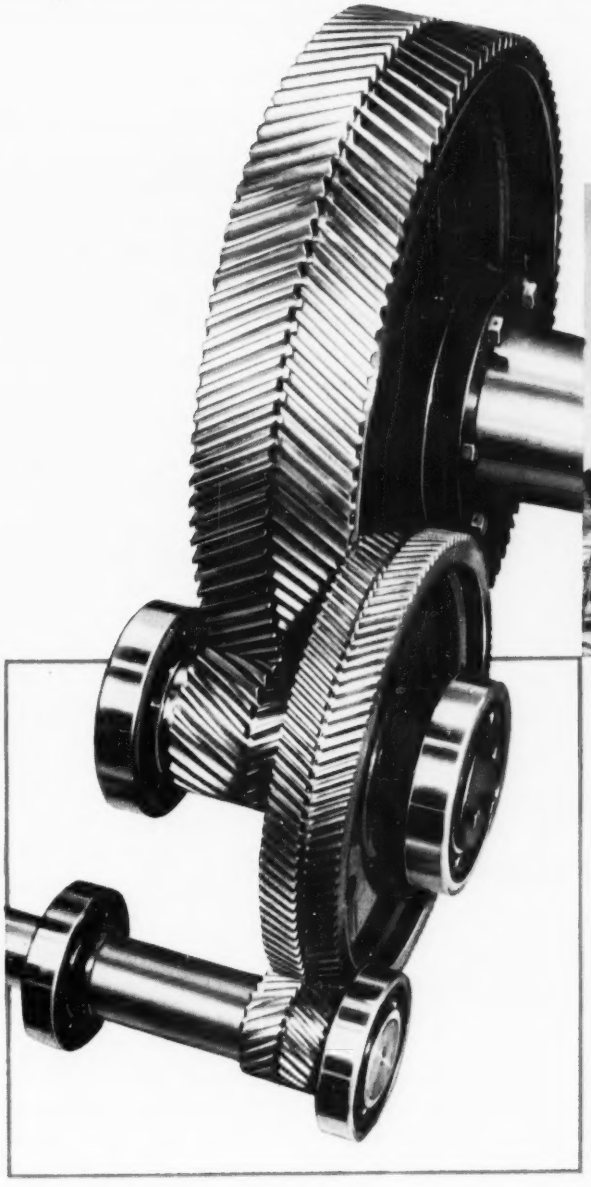
BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
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Standard Pressed Steel Co., Jenkintown, Pa.

BELTING, TRANSMISSION
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

(*Continued on page* 282)

FLOATING ON HYATTS!





This is a job for straight roller bearings, and EMSCO relies on HYATTS!

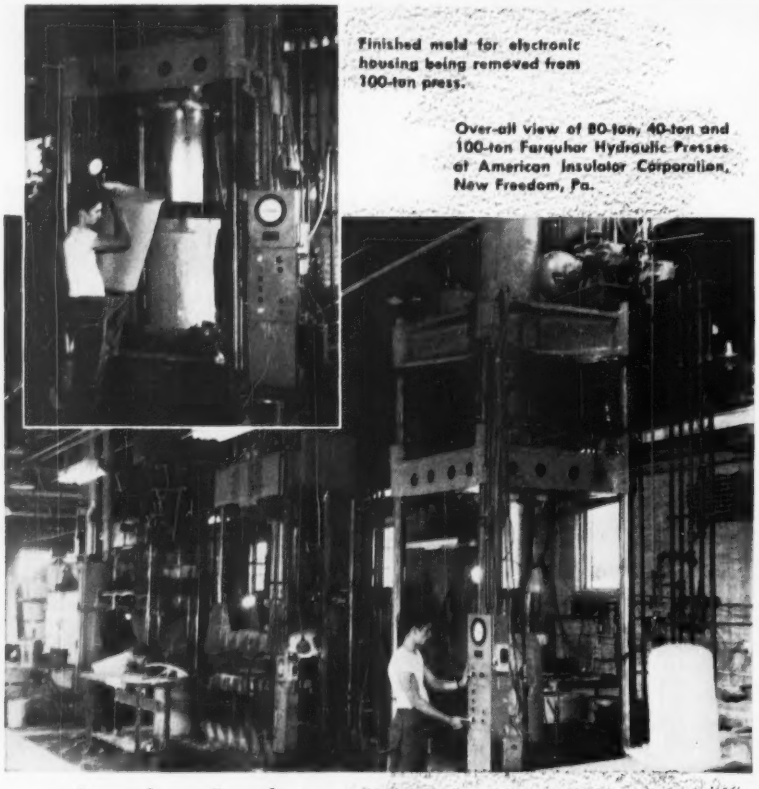
Take a good look at these herringbone gears—and at the four bearings supporting the two smaller shafts. These particular herringbones operate in the gear box of EMSCO's newest pumping unit, and the bearings are *Hyatt Hy-Loads!* For oilmen, this is a combination that means longer bearing life and lower maintenance costs, because only *straight radial bearings* permit these gears to locate themselves for most efficient operation. And when the application calls for radial-type bearings, EMSCO engineers specify Hyatts. Hyatts offer the proven advantages of easy assembly, simple maintenance, complete interchangeability of parts, and longer life. Insist on Hyatt Hy-Load Bearings for herringbone gear applications.

HYATT ROLLER BEARINGS

STRAIGHT ◯ BARREL ◯ TAPER ◯

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, NEW JERSEY

For more information on products advertised, use Inquiry Card, page 241



Finished mold for electronic housing being removed from 100-ton press.

Over-all view of 80-ton, 40-ton and 100-ton Farquhar Hydraulic Presses at American Insulator Corporation, New Freedom, Pa.

American Insulator reports:

FARQUHAR HYDRAULIC PRESSES give "closer tolerances and greater strength"*

*A battery of Farquhar Hydraulic Presses currently in operation at American Insulator Corp., New Freedom, Pa., was selected originally because the presses had to be custom-made, and Farquhar was in the best position to do this. In addition to this advantage, the Farquhar Presses have now proved to be more economical in operation and capable of maintaining closer tolerances due to greater rigidity of platens. So reports Mr. W. F. Remphrey, foreman of American Insulator's reinforced plastics division.

Three presses (40-, 80- and 100-ton) are used for molding fibre glass for production of classified electronic housings. The same job that formerly required an hour to mold through a vacuum process now takes only 6 *minutes* on a Farquhar Press! The hydraulic presses feature an automatic cycle, with one-man loading.

Farquhar Presses Cut Your Costs

The above installation is just one more example of Farquhar performance in heavy production! Farquhar Presses are built-for-the job . . . assure faster production due to rapid advance and return of the ram . . . greater accuracy because of extra long guides on the moving platen . . . easy, smooth operation with finger-tip controls . . . longer life due to positive control of speed and pressure on the die . . . long, dependable service with minimum maintenance cost!

For a free catalog showing Farquhar Hydraulic Presses in all sizes and capacities for all types of industry, write to: THE OLIVER CORPORATION, A. B. Farquhar Division, *Hydraulic Press Dept.*, 1504 Duke St., York, Pa.

Farquhar HYDRAULIC PRESSES

THE OLIVER CORPORATION • A. B. FARQUHAR DIVISION

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American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

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Republic Steel Corp., Steel and Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only)
Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

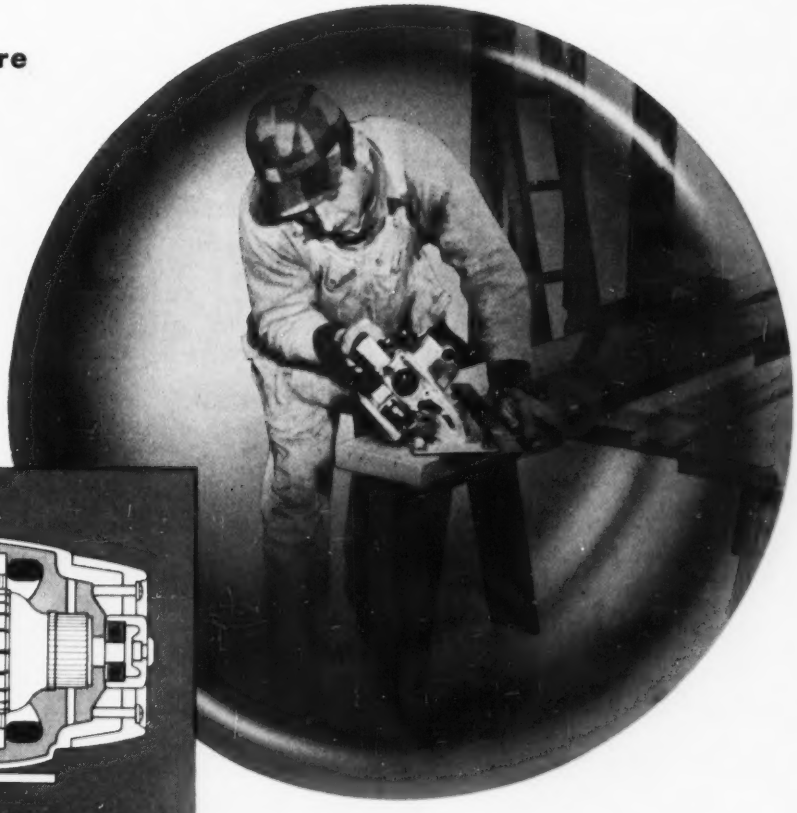
BOLTS, T-Slot
O. K. Tool Co., Milford, N. H.

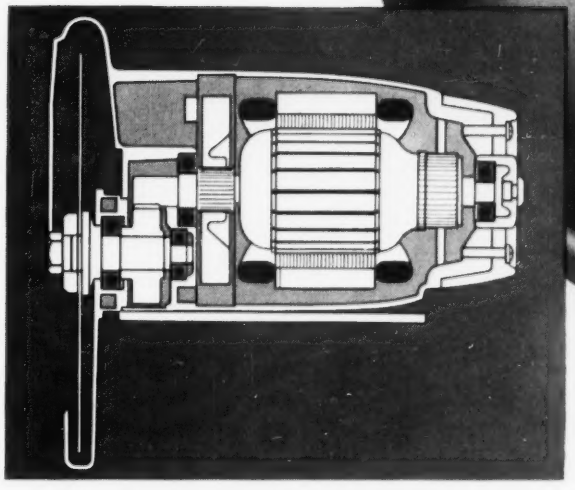
(*Continued on page* 284)

For more information on products advertised, use Inquiry Card, page 241

BUILDING BOON!

New Departures assure smooth, high-speed operation for Porter-Cable tools!





Four New Departure **ball** bearings in Porter-Cable's No. 115 saw contribute importantly to its dependable, trouble-free operation.

Long hours of heavy work without letup! New Departure precision **ball** bearings help keep Porter-Cable's No. 115 saw on the job. These bearings preserve alignment of moving parts under all conditions . . . require almost no upkeep . . . assure smooth, clean cutting and a cool-running motor for hours on end.

New Departure **ball** bearings bring advantages like these to hundreds of machines and appliances. Whether improving a product or designing a new one, *talk with your New Departure engineer.* He'll help you get maximum efficiency and economy in bearings.

NOTHING ROLLS LIKE A BALL



NEW DEPARTURE
BALL BEARINGS

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT
Plants also in Meriden, Connecticut, and Sandusky, Ohio
In Canada: McKinnon Industries, Ltd., St. Catharines, Ontario

NEW DEPARTURE SALES ENGINEERING OFFICES—AT YOUR SERVICE

BRISTOL	269 North Main St.	2-6371	**DETROIT**	7-122 General Motors Bldg.	Trinity 2-4700	**KANSAS CITY**	1021 E. Linwood Blvd.	Valentine 4939
BOSTON	517-A Park Square Bldg.	Hancock 6-9867	**CINCINNATI**	2107 Carew Tower	Main 5783	**MILWAUKEE**	647 W. Virginia St.	Broadway 6-9460
KANNAPOLIS, N. C.	P. O. Box 1086	2-3181	**CLEVELAND**	3113 W. 110th St.	Winston 1-5454	**ST. LOUIS**	3001 Washington Blvd.	Franklin 6533
NEW YORK	1775 Broadway	Circle 6-1540	**INDIANAPOLIS**	1357 W. 18th St.	Imperial 4680	**LOS ANGELES**	5035 Gifford Ave.	Logan 8-2301
PHILADELPHIA	850 E. Luzerne St.	Garfield 3-4136	**PITTSBURGH**	Cathedral Mansions	Mayflower 1-8100	**BERKELEY**	1716 Fourth St.	Landscape 6-8750
SYRACUSE	2360 James St.	73-5195	**CHICAGO**	332 So. Mich. Ave.	Wabash 2-5875	**SEATTLE**	5000 First Ave., S.	Lander 5920
			DAVENPORT	2212 E. 12th St.	Davenport 7-7522			



Whether it's for a custom built rifle or mass produced precision parts.

The gunsmith, like Vinco, has the specialized "know-how" that creates extra quality.

The men in our production division have years of specialized experience in the precision machining of MAGNESIUM, BRONZE, ALUMINUM, CAST IRON and STEEL parts. Our machining facilities are so versatile that many varieties of parts, in a wide range of sizes, can be produced in quantities from a few pieces up to multiple thousands.

Your company will profit because our prices are low, scrap is held to a very minimum, and deliveries are made on schedule.

This is why Vinco specialists are your best bet.

VINCO CORP., 9113 Schaefer Hwy., Detroit 28, Mich.

Aircraft and Commercial Gears • Master Gears • Spline Gages • Precisiondex • Gear Rolling Inspection Fixtures • Recording Camshaft Comparators • Optical Master Inspection Dividing Heads • Involute Checkers • Indicator Snap Gages • B-1 and Special Formed Wheel Dressers.

VINCO ®

MILLIONTHS OF AN INCH FOR SALE

TRADEMARK OF DEPENDABILITY

BOOKS, Technical

Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Canedy-Otto Div. Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING AND TURNING MILLS, Vertical

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING BARS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Homestrand Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

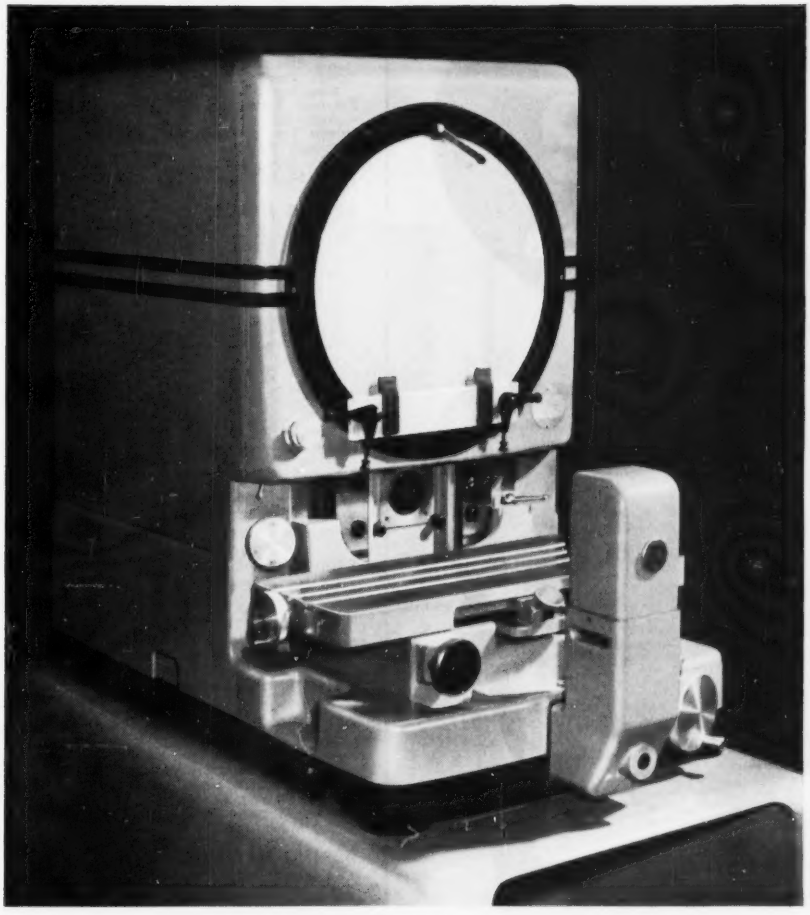
BORING, DRILLING AND MILLING MACHINES, Horizontal

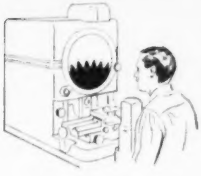
(Floor, Planer or Table Types)

Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5 Ind.

(*Continued on page 286*)

For more information on products advertised, use Inquiry Card, page 241





For maximum versatility in production inspection...

the NEW KODAK CONTOUR PROJECTOR, Model 4

You'll find setups are faster, fixturing easier when you use the Kodak Contour Projector, Model 4, for routine gaging of precision parts.

Designed for use on the inspection line, it has a movable table with 4 inches of travel in both horizontal and vertical directions. This lets you handle a wide variety of parts with simple fixturing.

The Kodak Contour Projector, Model 4, has the same unique optical system as the famous Kodak Contour Projectors, Models 2A and 3. The 14-inch viewing screen covers a field of 1.4" at 10× magnification. Vertical illuminator, surface illumination, six-power lens turret, and rotating screen with protractor ring are available as accessories. For complete details, write to:

EASTMAN KODAK COMPANY
Special Products Sales Division
Rochester 4, N.Y.

the KODAK CONTOUR PROJECTOR

Kodak

Adaptable

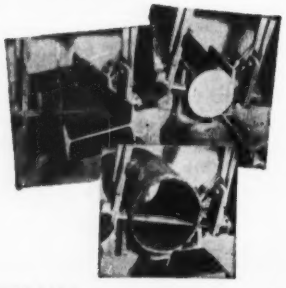
TO ANY CUTTING JOB



Model J 10" x 18" Capacity

The flexibility of the JOHNSON BAND SAW in handling all types of cutting is almost unlimited

Cuts Rods, Tubes,
Angles, Heavy Rounds,
Flats, Irregular Shapes,
Cuts Quickly
and Economically



WRITE FOR DETAILS

JOHNSON MANUFACTURING CORP.
ALBION, MICHIGAN

Modern Ind. Engrg. Co. 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5 Ind.
Mummert-Dixon Co., Hanover, Pa.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Bryant Chucking Grinder Co., Springfield, Vt.
Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St. Worcester 6, Mass.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5 Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Simplex Machine Tool Corp., 4528 W. Mitchell St., Milwaukee, Wis.

BORING MACHINES, Jig

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc. 200 Lafayette St., New York 12, N. Y.

BORING TOOLS

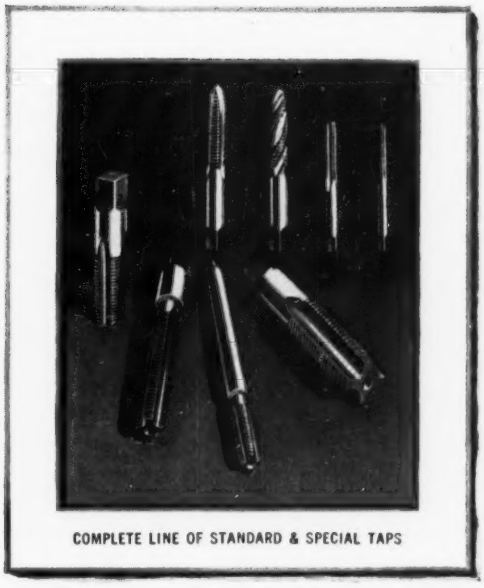
American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.

(Continued on page 288)

For more information on products advertised, use Inquiry Card, page 241



NEW PLASTIC TAP BOXES



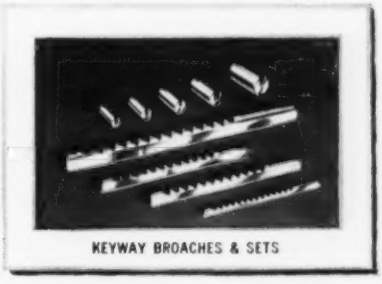
COMPLETE LINE OF STANDARD & SPECIAL TAPS

PROTECTED QUALITY

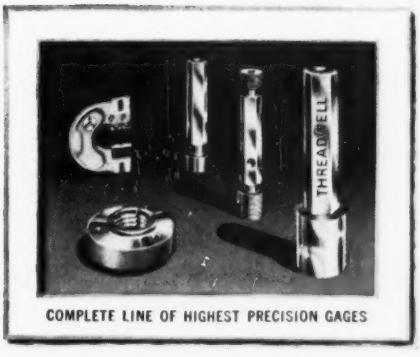
It's apparent how Threadwell TAP quality is protected by the original plastic tap package shown above. BUT . . . the quality of ALL Threadwell products is ***triple protected.*** At the ***factory*** by rigid process and individual final inspection . . . in ***transit and storage*** by advanced packaging and clear labeling . . . and in ***use*** by Threadwell Field Engineers strategically located nation wide to help you with cutting tool and gaging problems on the job.



ADJUSTABLE ROUND, 2-PIECE & HEXAGON DIES



KEYWAY BROACHES & SETS



COMPLETE LINE OF HIGHEST PRECISION GAGES

THREADWELL DISTRIBUTORS, too, are strategically located to serve you promptly, properly, and well.

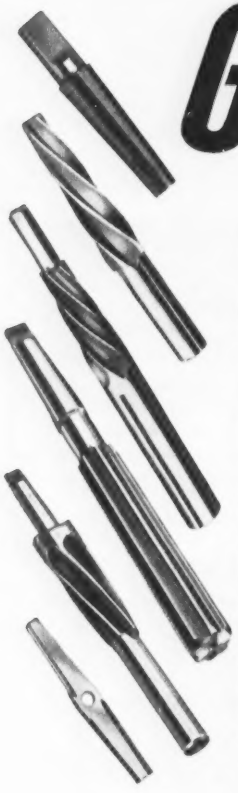


THE FINEST IN CUTTING TOOLS & GAGES



FOR SPECIAL REAMERS . . . REMEMBER

GORHAM



They may not *look* alike, but all of the special tools on this page share a common function . . . *because every one is a reamer!* Each was engineered and manufactured by Gorham Tool Company to provide a practical solution to a specific production machining problem for one of our customers.

Actually, these reamers represent just a few of the many special-purpose cutting tools produced by Gorham. Others include milling cutters and end mills, inserted blade cutters, flat and circular form tools, profile cutters, and carbide tipped tools of every description. Gorham "specials" are turning problems into profits in thousands of plants every day . . . and the one we engineer for you will solve *your* next production machining problem, too! Take advantage of our experience.

Your nearby Gorham Field Engineer is a qualified cutting tool expert in both practical design and actual application, and his assistance is yours without obligation. Just write for his name, or send details of your problem direct to us. We'll have him get in touch with you promptly.

Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

14405 WOODROW WILSON • DETROIT 3, MICHIGAN

WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bliss E. W., Co., 1375 Raff Road, S. W., Canton, Ohio.
Cincinnati Shaper Co. Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Wilson, K. R., 213 Mill St., Arcade, N. Y.
Zagar Tool Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md. (Portable Elec.).
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.

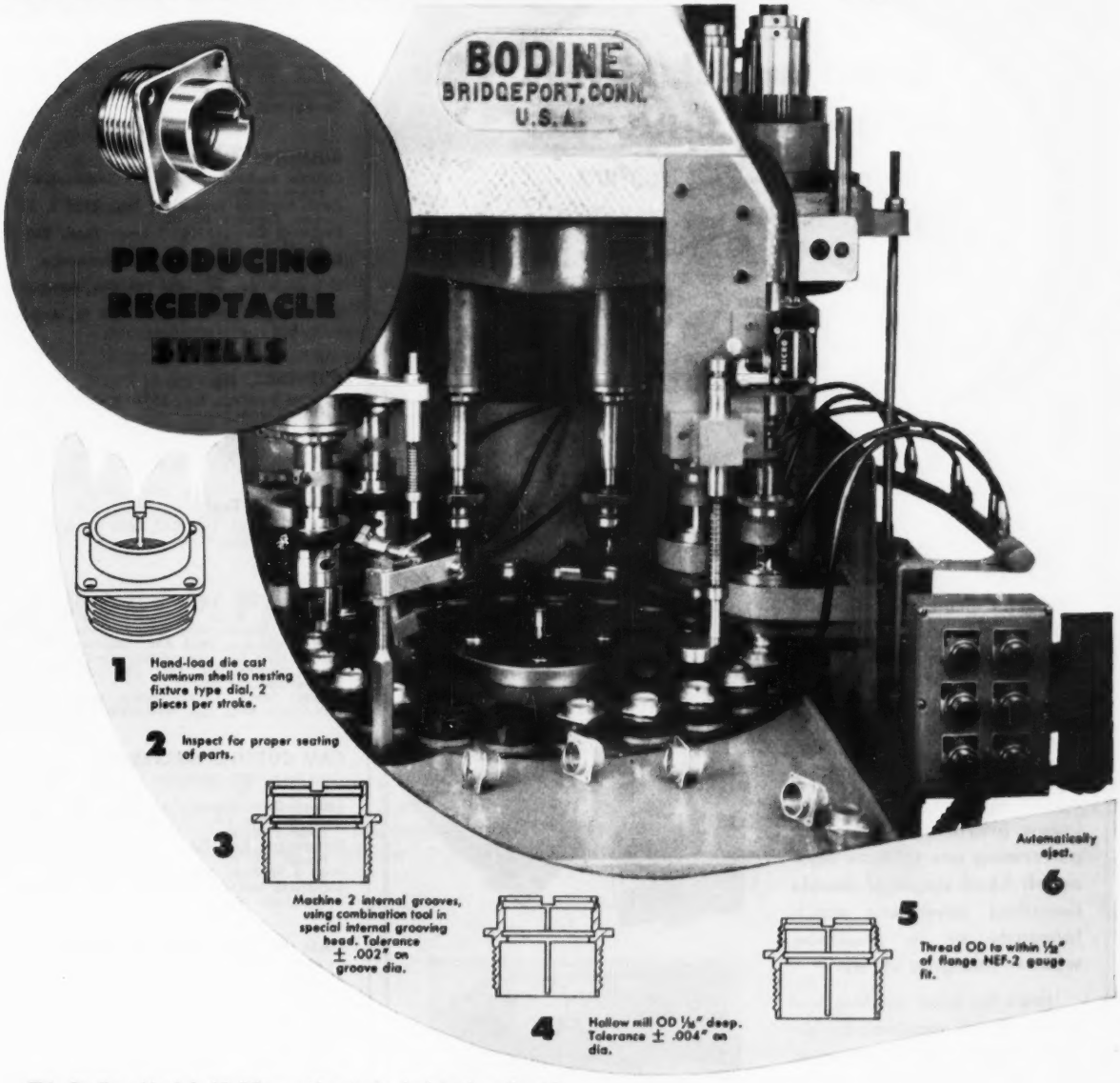
BULLDOZERS

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hufford Machine Works, Inc. (Stretch-wrap) 1700 E. Grand Ave., El Segundo, Cal.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

(*Continued on page 290*)

For more information on products advertised, use Inquiry Card, page 241

Bodine CASE HISTORY NO. 38



This Bodine Model 48-30 machine is tooled to handle 13 receptacle shells ranging from 7/16-27 to 1 3/8-18 NEF 2 threads. Shells are used for multiple terminals in TV, Radar, etc.

PRODUCTION: From 1,600 to 2,200 pieces per 50-minute hour, depending on size of shell.

Potentiometers next to push button station regulate two electronically controlled variable speed motors. Positive, accurate control over spindle rpm and over rate of feed gives lead-screw accuracy to the threads with a non-reversing spindle.

Bodine machines (of four types) may be tooled for an extremely wide variety of high speed repetitive production jobs . . . including drilling, tapping, threading, screw inserting, light milling, and assembly. For a true picture of cost cutting, write Dept. M-8 for our brochure "Bodine Presents 12 Typical Case Histories."

"You Can't Meet Tomorrow's Competition with Yesterday's Machine Tools."

THE **Bodine** CORPORATION
BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

ONLY

GOSS and DELEEUW AUTOMATIC CHUCKERS

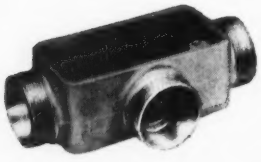
offer the 1-2-3 feature

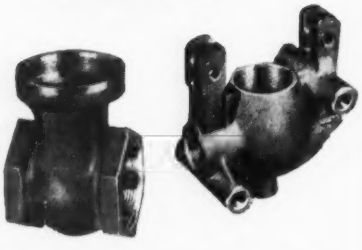


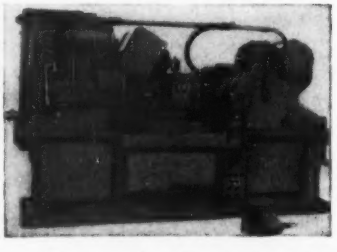
This NEW development—unsurpassed for speed, convenience of tooling and precise finish—involves no retooling problem even for short runs. It assures greater production at lower cost on all classes of work.

The unique "1-2-3" feature, exclusive with Goss & De Leeuw, provides the means for performing one to three right or left hand single or double threading operations simultaneously or in sequence, without changing set up.

Here's an ideal machine tool for small lot requirements because of quick, easy changeover. Any class of chuck work can be handled economically in any quantity.







The examples of work shown here are typical of the wider variety of parts being produced on these new machines.



SEND FOR detailed information on this new machine. Let us have samples of your work in order to give you time and cost estimates for handling it on the "1-2-3" Goss & De Leeuw.

GOSS & DELEEUW QUALITY PRODUCT QUANTITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

BURS
See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

BUSHINGS, Hardened
Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig
Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS
Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

CAM CUTTING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CAM MILLING AND GRINDING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Waynesboro, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Corp., 1340 W. Vernor Hwy., Detroit 1, Mich.

(*Continued on page 292*)

For more information on products advertised, use Inquiry Card, page 241

the best running mate your product can have–

DELCO MOTORS

With exceptionally long life and outstanding quality built in . . . with worldwide recognition and acceptance—a Delco motor adds a unique plus value to any product it serves.

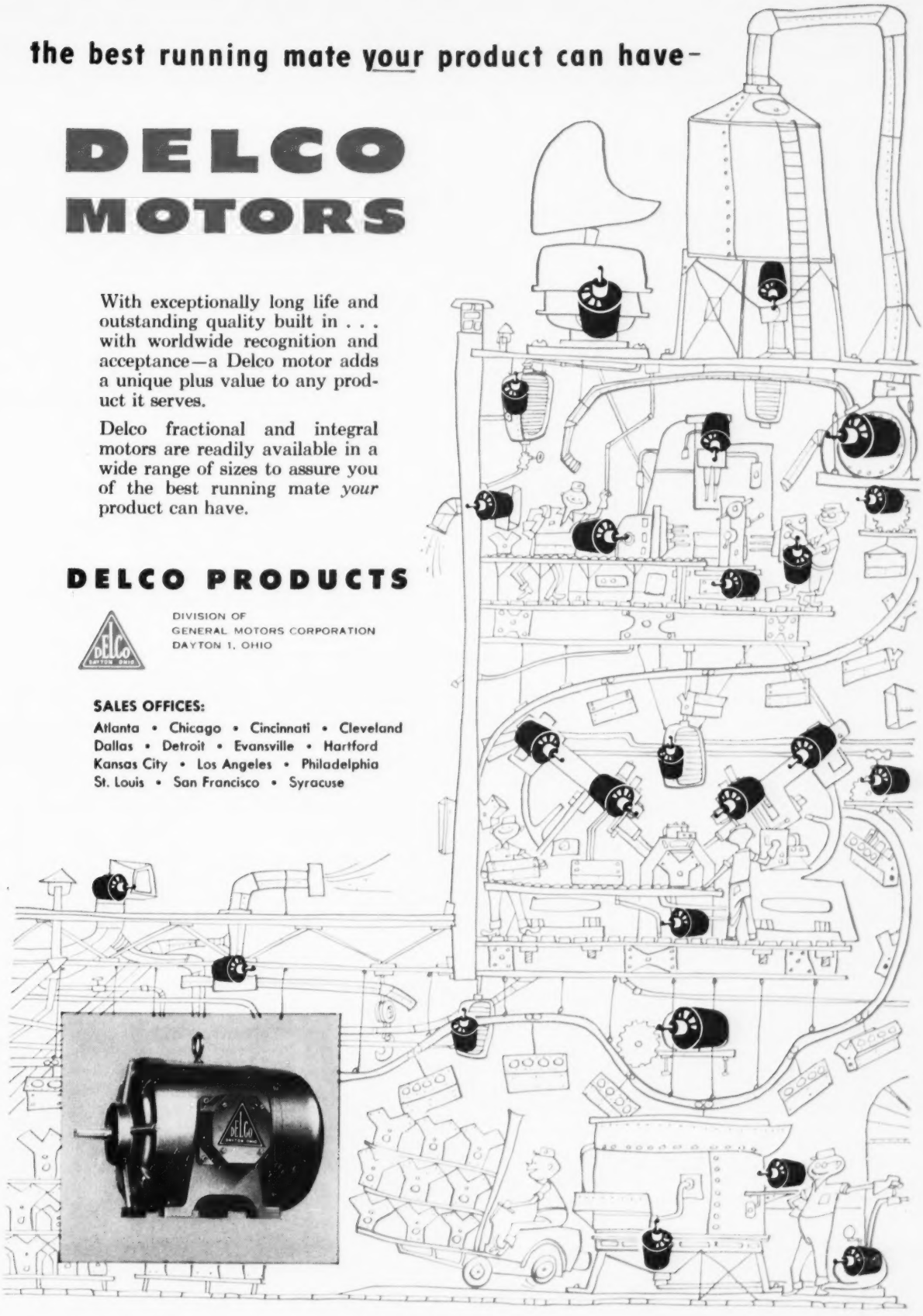
Delco fractional and integral motors are readily available in a wide range of sizes to assure you of the best running mate *your* product can have.

DELCO PRODUCTS

DIVISION OF
GENERAL MOTORS CORPORATION
DAYTON 1, OHIO

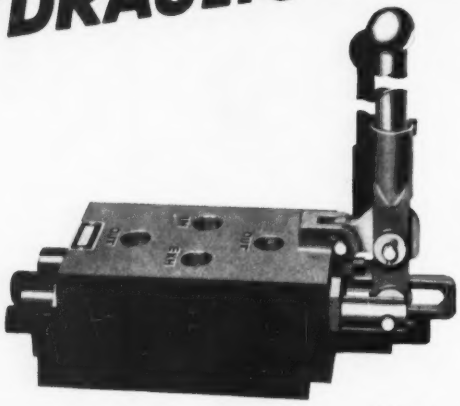
SALES OFFICES:

Atlanta • Chicago • Cincinnati • Cleveland
Dallas • Detroit • Evansville • Hartford
Kansas City • Los Angeles • Philadelphia
St. Louis • San Francisco • Syracuse



Quick-As-Wink®

HYDRAULIC VALVES

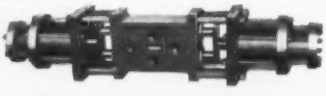


Hand Lever and Pilot Cylinder Types—pressures to 5000 psi.

Have won industry wide recognition
for unsurpassed dependability

• Positive and fast acting, Quick-As-Wink Control Valves are designed and built to meet the most exacting requirements. Bodies of hydraulic valves are either forged or milled from solid bars. The hollow, radially ported, stainless steel plungers are chrome plated and polished to minimize wear. All parts are readily accessible and maintenance—that consists mostly of the very occasional replacement of the packing — can be done easily **in the field** without even disconnecting the piping. This avoids the necessity of returning valves to the factory for servicing or maintaining large standby inventories. Let us recommend the sizes and types that will meet your requirements best. Write for Bulletin 531. It gives full details.

Ask us also about . . .

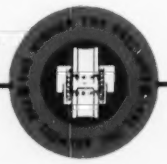


DOUBLE PILOT CYLINDER HYDRAULIC VALVES operated with air or hydraulic pilot cylinders—3 position; neutral, compound-on or compound-exhaust.



DOUBLE SOLENOID "O-TYPE" VALVES for pressures up to 125 psi. Widely used as pilot valves and for operating air cylinders.

Quick-As-Wink
AIR AND HYDRAULIC
Control Valves



Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

***Mfd. by* C. B. HUNT & SON, INC., 1945 East Pershing St., Salem, Ohio**

CASEHARDENING FURNACES
See Furnaces, Heat-Treating

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

CASTINGS, Die
American Brass Co., Waterbury 20, Conn.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Madison-Kipp Corp., Madison, Wisc.

CASTINGS, IRON
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.

CASTINGS, Steel, Alloys, Etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Lebanon Steel Foundry, Dept. J, Lebanon, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Synder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

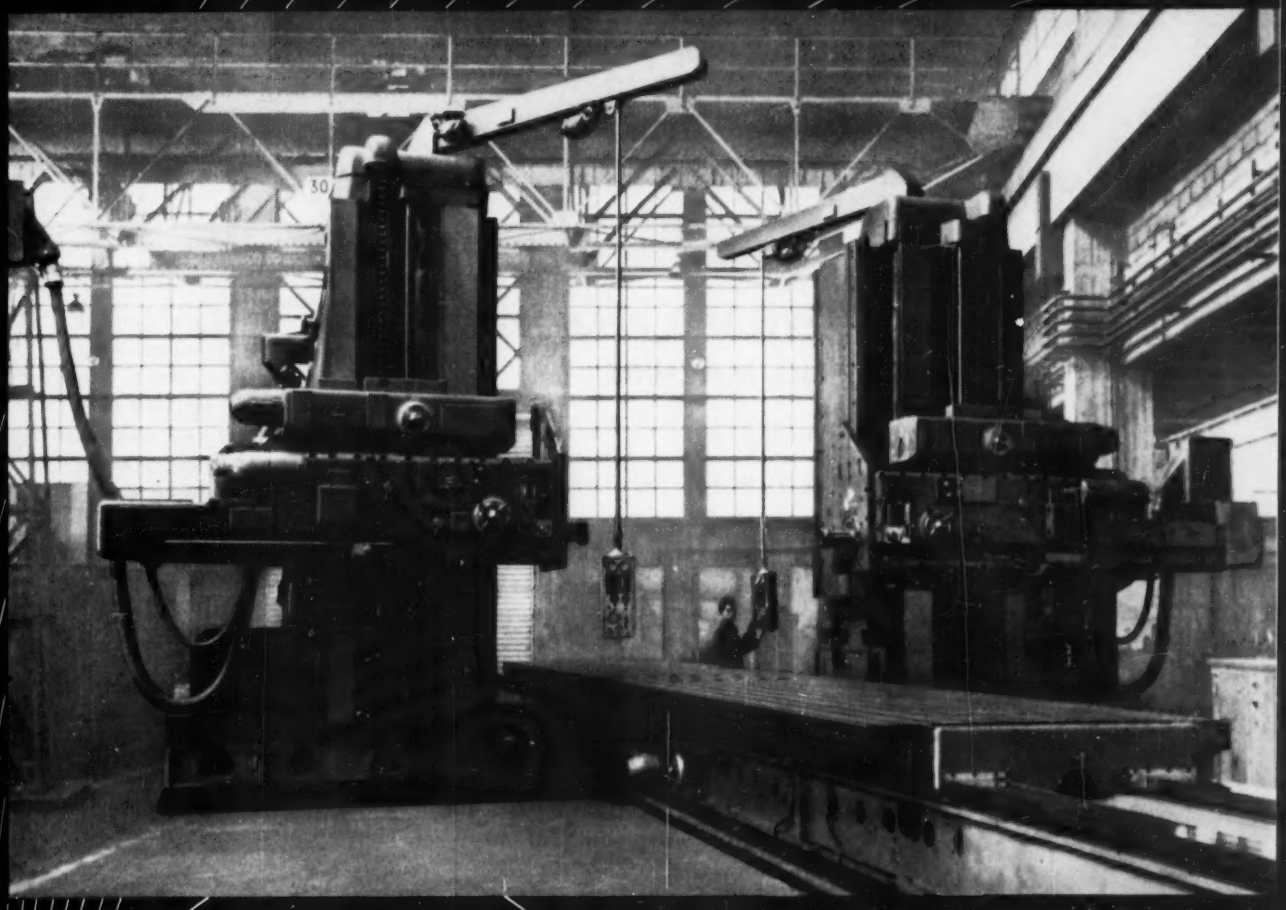
CENTERS, Lathe
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd. Plymouth, Mich.

(*Continued on page 294*)

For more information on products advertised, use Inquiry Card, page 241

INNOCENTI

Lic. CWB



DOUBLE MILLING AND BORING MACHINE "F.A.P." (Planer Type) 2 M

Available power for cutter on each headstock: 40 HP.

Possibility of coupling the two spindles for machining turbine bodies.

Minimum overhang, maximum rigidity by approaching of columns and headstocks.

Heavy boring operations with the feed of columns: boring travel at request.

Series operations by automatic cycles; electric control.

Control from pendant box of all automatic, simultaneous or separate feed movements; spindle speed selector; slides locking.

Additional swinging arm or cross-beam can be provided with one or two milling vertical headstocks.

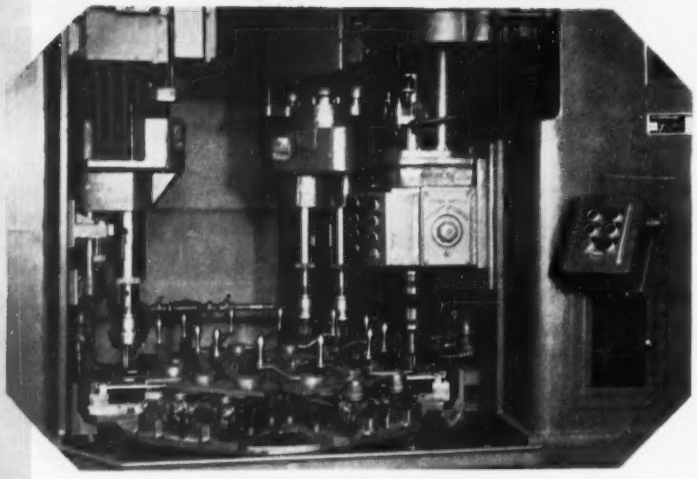
Spindle speeds: 1,3 to 640 rpm.

Weight: 160 tons.

INNOCENTI

PARIS MILAN NEW YORK

Another Cleveland Design to Speed Production!



COMBINATION CLEVELAND REAMING AND TAPPING MACHINE

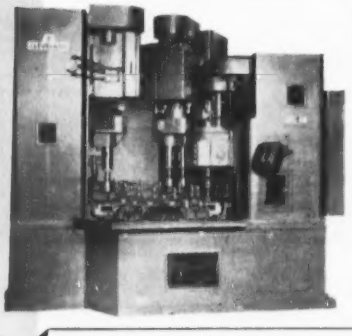
OPERATION: Rough taper ream two parts at a time. Finish taper ream two parts at a time. Tap with taper pipe tap two parts at a time.

PARTS: Union End Forgings.

PRODUCTION:

Size	*Parts Per Cycle*	*Prod. at 100% Efficiency*
1¼"-11½	2	316 per hour
1¾"-11½	2	256 per hour
2"-11½	2	200 per hour

A vertical combination machine consisting of a heavy duty Cleveland 21" Power Index Table, mounted on an all welded and normalized steel base with columns on the rear of the table supporting two drill units, each with a two spindle head and one Cleveland Model F-2 two spindle heavy duty tapping unit.



Mounted on the top plate, twelve hand operated locating and clamping fixtures, with interchangeable jaw sets.

Write today for Catalog No. MY-84

CLEVELAND
tapping machine co.
A Subsidiary of AUTOMATIC STEEL PRODUCTS, INC. • CANTON 6, OHIO



CHAINS, Power Transmission and Conveyor
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS
Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

CHUCKING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co., (Single and Multiple Spindle) 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Air Operated
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hufford Machine Works Inc., 1700 E. Grand Ave., El Segundo, Cal.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Schrader' Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Whiton Machine Co., 190 Howard St., New London, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split
See Collets

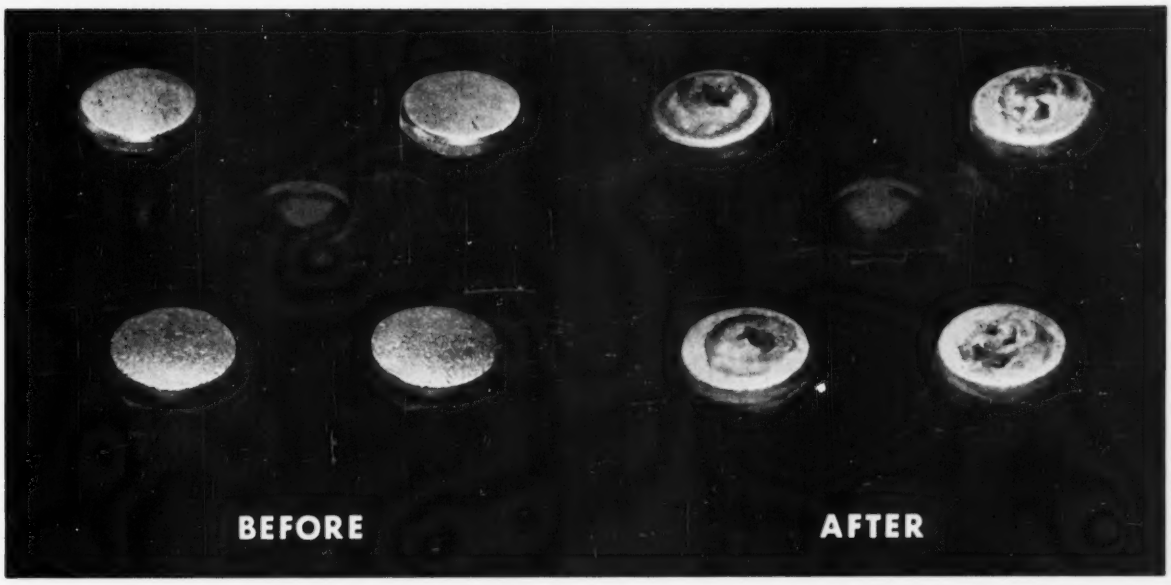
CHUCKS, Diaphragm
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfield 7, Mass.
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Drill
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHUCKS, Full Floating
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

(*Continued on page 296*)

For more information on products advertised, use Inquiry Card, page 241



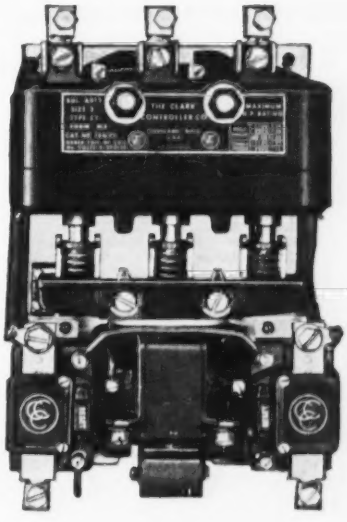
PROOF OF LOW MAINTENANCE ON CLARK TYPE "CY" STARTERS

These unretouched photos show contact tips from a CLARK Bulletin 7707 contactor—the contactor used in the standard Bulletin 6013 size 2 AC Motor Starter — as they looked before and after a year of hard use.

The contactor is in service at Cleveland Hone and Manufacturing Company, on a special transformer and rectifier circuit used in processing automotive parts. The tips shown right above were removed from the contactor after 12 months of steady service, often operating as frequently as 5000 times per hour.

Note that slight discoloration and minute pitting are the only evidence of wear. They require no cleaning, dressing or filing, and are in condition to give many more years of dependable service.

The secret of long contact life in the CLARK Type "CY" Starter is its exclusive arc-quenching principle, using strong multi-turn magnetic blowouts and double-break contacts. Forced rotation causes the arc to move continually on the contact surfaces, distributing the heat and preventing pitting or "build-up" at any one point. Result: extremely effective arc interruption, and greatly reduced wear on tips.



CLARK Type "CY" Starters include many more features for dependable service and reduced maintenance. Let us tell you the complete story.

Write for descriptive literature.

THE CLARK CONTROLLER CO.

ENGINEERED ELECTRICAL CONTROL • 1146 EAST 152ND STREET, CLEVELAND 10, OHIO

STAMPINGS

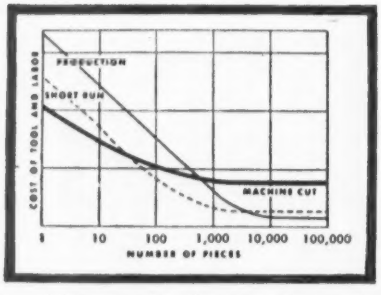
ONE PIECE
OR ONE MILLION

Our impartial use of **three** basic methods gives you economy regardless of length of run.

Most parts can be made by all three methods. But only **one** is **most** economical. The right decision is a technical one, based on **over-all** quantity, contour dimensions, tolerances and materials.



YOUR SUPPLIER SHOULD
KNOW ALL THREE METHODS



This logarithmic chart shows the effect of these factors on the **specific part** illustrated. From 1 to 65 parts, our own Machine-Cut Method with standard dies is most economical. At 65 parts, the Short-Run Method using economical blanking dies and stock punches is best until, at 7,000 units, the standard Production Method with standard dies is most satisfactory.

SEND FOR INFORMATIVE LITERATURE

STAMPINGS
DIVISION
LAMINATED
SHIM
COMPANY, INC.

3908 Union Street, Glenbrook, Conn.

CHUCKS, Gear

Gleason Works, 1000 University Ave., Rochester, N. Y.
Horton Chuck, Windsor Locks, Conn.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Lathes, etc.

Buck Tool Co., 220 Schippers La., Kalamazoo, Mich.
Bullard Co. Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Whiton Machine Co., 190 Howard St., New London, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jarvis, Charles L., Co., Middletown, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Gardener Mch. Co., Div. Landis Tool Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y.

CLAMPING APPLIANCES FOR MACHINE TOOLS

Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

CLAMPS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St. Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal

Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York N. Y.

CLUTCHES

Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Formsprag Co., 23609 Hoover Rd., Van Dyke, Mich.
Link-Belt Co., 300 West Pershing Rd., Chicago 9, Ill.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

COLLARS, Safety

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS

See Gages, Comparator.

COMPARATORS, Optical

DoAll Co., 254 Laural Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York.

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lopping).
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Shear-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

(*Continued on page* 298)

KEMPSMITH
Defiance

HORIZONTAL BORING · MILLING · DRILLING MACHINES

The KEMPSMITH-Defiance line typifies KEMPSMITH leadership in terms of the *first* table-type Horizontal Boring Mill with Outboard Supports as an integral part of every machine. Here is a really good buy for general manufacturing, jobbing, tool and die work, because . . . without any extravagant frills . . . the KEMPSMITH-Defiance provides versatile, dependable, high-speed, precision boring, milling and drilling machine performance. Optional Low Speed Arrangement is an integral part of the head-stock. Massive oversize construction assures accuracy, rigidity and strength for permanence.

The KEMPSMITH-Defiance line is being manufactured initially with 4-inch and 5-inch diameter spindles, powered by 15 HP and 25 HP motors respectively. A variety of Table, Column and Bed Sizes are available to meet your needs. Nitralloy Spindles have Timken mountings.

A complete line of accessories is also available.



Write for Bulletin No. 136

A few territories still open for distributors. Write to:

KEMPSMITH MACHINE CO.
Milwaukee 14, Wisconsin, U. S. A.

KEMPSMITH

PRECISION-BUILT MACHINE TOOLS SINCE 1888

an ACCO product

Wilson "Rockwell"* Hardness Testers

New Motorized
*WILSON "ROCKWELL"** Hardness Tester with
*SET-O-MATIC** Gauge



SET-O-MATIC* DIAL GAUGE

Eliminates human error. Operator merely applies minor load and taps depressor bar. No setting of dial to zero.

OTHER FEATURES

- Major load applied under dash pot control
- Major load removed by motor
- Illuminated Dial Gauge
- Illuminated Penetrator

Eliminates Operations... Increases Tests per Hour

All you have to do with the Model Y WILSON "ROCKWELL" Motorized Hardness Tester is apply the minor load and tap the major load depressor bar. The machine does everything else automatically. The cycle of Major Load operation may be less than 2 seconds.

This speed of test means great savings in time which will reduce your hardness testing costs. Yet it is done to Wilson's high standard of accuracy.

The utter simplicity of setting the SET-O-MATIC* dial gauge eliminates human error. The operator does not have to set the dial. The large pointer is automatically brought to "SET" position when the minor load is applied.

The Model Y Motorized WILSON "ROCKWELL" Hardness Tester is in production and orders are being accepted for early delivery. Write today for descriptive literature and prices.

*Trade Marks

ACCO
Wilson Mechanical Instrument Division
AMERICAN CHAIN & CABLE
230-D Park Avenue, New York 17, N. Y.

plus BRALES and TUKON

COMPOUNDS, Resin and Moulding
General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St. New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., 760 S. 13th, Newark 3, N. J.
Fellows Gear Shaper Co., Springfield, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

CONTROLS for Electrical, Hydraulic and Pneumatic Units
Saginaw Steering Gear Div. General Motors Corp., Saginaw, Mich.

CONTROLLERS
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio.
General Electric Co., Schenectady 5, N. Y.

CONTROLS, Thermo
Control Products, Inc., 306 Sussex St., Harrison, N. J.

CONVEYORS FOR DUST, CHIPS, ETC.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9.

COOLANT SEPARATORS
See Separators, Oil or Coolant.

COUNTERBORES
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Besly-Welles Corp., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wison, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

(*Continued on page 300*)

For more information on products advertised, use Inquiry Card, page 241

Now . . .

You can produce MORE for LESS with

"ONE STOP" TOOLING SERVICE



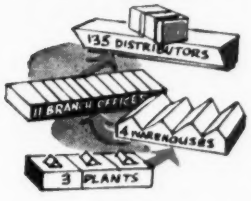
Profit, today, must come from production . . . with overhead, sales, labor, and material costs at constant or increasing high levels. The need to produce more product for the same money or the same volume of product for less money makes *tooling* the *key* to profit!

Only Firth Sterling can serve you so completely in solving the tooling problems that enable you to make production profits . . . for these six convincing reasons:

UNBIASED RECOMMENDATIONS Because Firth Sterling makes *both* steel and carbide tooling materials, you get completely unbiased recommendations. The exactly right tools or tooling materials will be matched to your production needs, resulting in better, faster, cheaper production.



UNLIMITED SELECTION *Only* Firth Sterling offers so many grades, styles and sizes of both steels and carbides from *one* source of supply . . . 16 High Speed Steels, 53 Tool and Die Steels, 6 High Temperature Alloys, 12 Tungsten Carbides embracing standard tools and tips, toolholders and inserts, dies, perforators, and "specials" *plus* Chromium Carbides, Stainless Specialties, Titanium Carbide Cermets, Firth Heavy Metal, and Zirconium!



EFFECTIVE NATIONAL DISTRIBUTION Three plants, 4 warehouses, 11 branch offices and 135 distributors strategically located in the manufacturing centers of the country assure readily accessible supply sources for all your tooling needs.



CONSTANT RESEARCH Continuing full-scale research with emphasis on product improvement, specialty steels, carbides, new metals and new methods assures you years-ahead tooling procedures when you make Firth Sterling your one-stop source of supply.



PACKAGED TOOL LINE The most complete line of packaged tools available comes in standard quantities, easy to handle, stock, identify and inventory . . . in both steel and carbide.



ONE SOURCE MAKES SENSE Yes, only Firth Sterling can so adequately provide one-stop, one-source-of-supply tooling service with its assurance of unbiased recommendations, simplified lower-cost ordering . . . resulting in better, faster, cheaper production. It makes sense, doesn't it? Ask Firth Sterling to analyze your tooling problems . . . to produce *more* for *less.*

R-297

Firth Sterling

—INC—

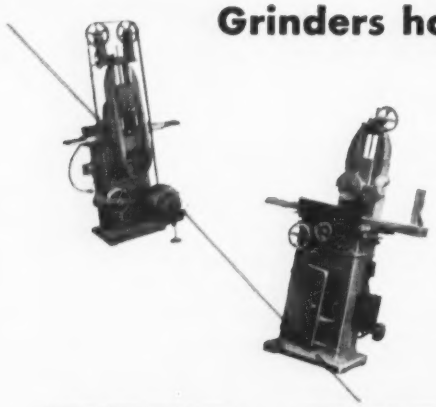
GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

OFFICES AND WAREHOUSES*: BIRMINGHAM CHICAGO* CLEVELAND DAYTON DETROIT* HARTFORD* HOUSTON LOS ANGELES* NEW YORK PHILADELPHIA PITTSBURGH WASHINGTON WESTFIELD, N.J.

PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool and Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets
Zirconium

For more information on products advertised, use Inquiry Card, page 241



Grinders have changed . . .

IT'S TIME YOU CHANGED GRINDERS

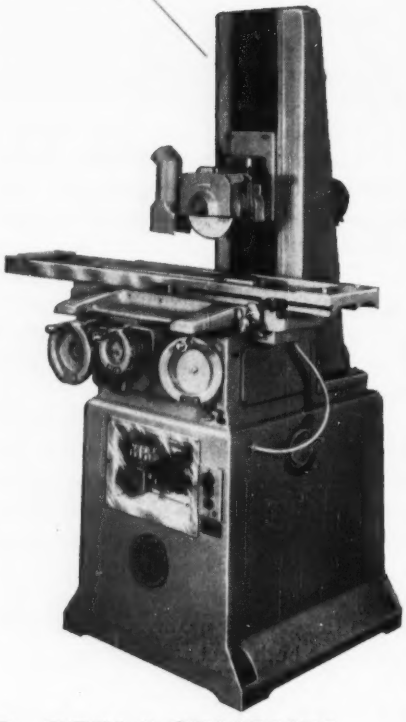
REID GRINDERS

built in '54 offer more improvements . . .

. . . improvements you can't afford to overlook, if your toolroom is to meet today's precision tooling demands—competently, quickly and profitably.

Finger-tip level controls for easier operation; one-piece column casting mounted *on* the base for maximum rigidity; hand-scraped ways for accuracy; telescoping dust plates for protection of vertical and cross feed mechanisms — these are but a few of the many improvements designed by our engineers to make Reid Grinders a standard of precision and dependability.

If your toolroom still harbors a surface grinder like those above, for the sake of efficiency,



PLAN NOW FOR REPLACEMENT!

Condensed specifications — Model 618V
Capacity: 6" x 18" x 17¼" (spindle center to table)
Work table: 51" x 8"
Power-feed table: variable, 12 to 35 ft./min.
Standard wheel: 7" x ½" x 1¼"
Weight: 2100 lbs. Floor space: 71" x 43½"

see our catalog in MACHINE TOOL CATALOGS or write for copy

Please request Catalog 618-2

Reid Brothers Company, Inc.

COUNTERSHAFTS
Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.

COUNTERS, Revolution
Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S. Co., Athol, Mass.

COUNTING DEVICES
Starrett, The L. S. Co., Athol, Mass.

COUPLINGS, Flexible
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.

COUPLINGS, Shaft
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Sier-Bath & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Morgan Engrg. Co., Alliance, Ohio.

CUTTER GRINDERS
See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

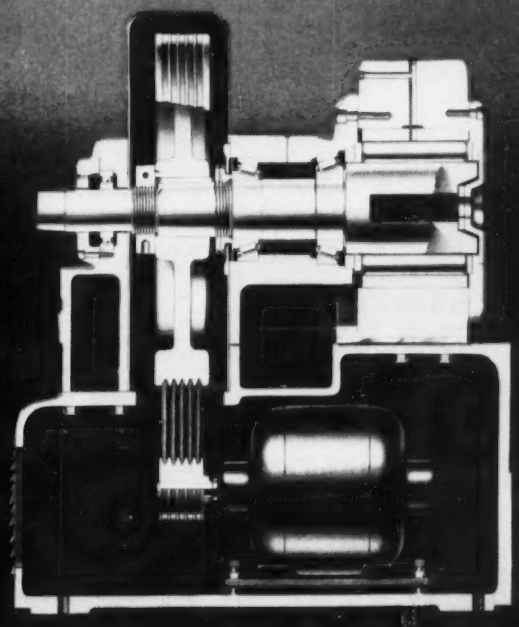
CUTTERS, Gear
Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wessen Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

(*Continued on page* 302)

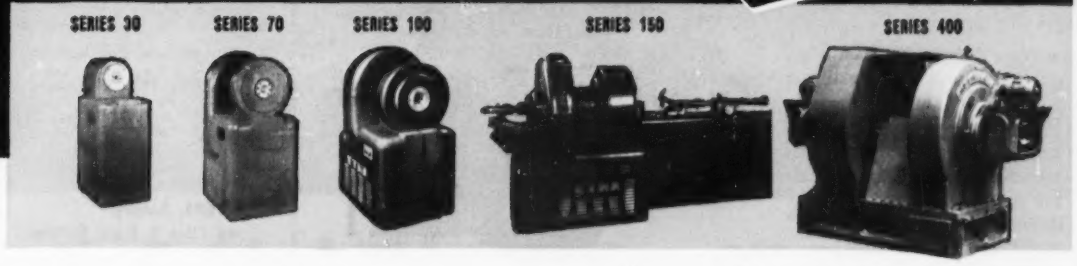
For more information on products advertised, use Inquiry Card, page 241

IF IT'S SWAGING... It's Etna..

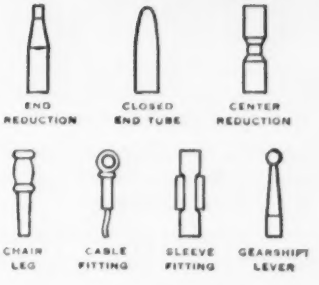
FOR CONTINUOUS PRECISION PRODUCTION!



A COMPLETE RANGE OF SIZES AND CAPACITIES



For tapering, sizing, reducing and forming to special shapes of round solids and steel tubing, the Etna Swaging Machine offers the ultimate in modern machine design. Regardless of size and description of the job to be done, there's an Etna swager right for *greater production*. Write today regarding your specific job problems.



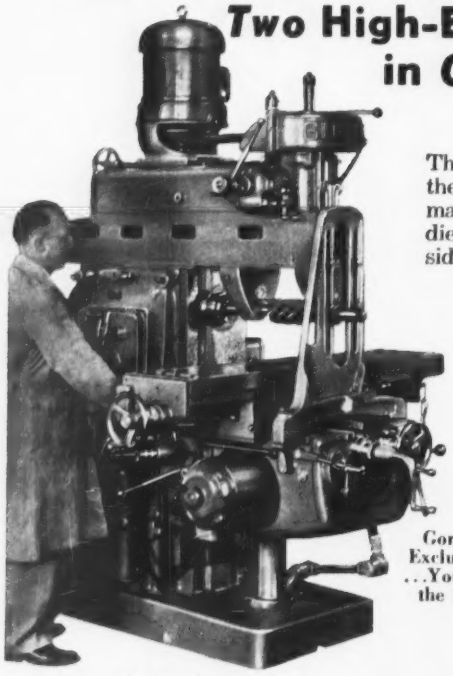
It's New! Get full information on the blending into the wall of I. D. Bead on steel and stainless steel tube with Etna Swagers resulting in mirror finish. Bead also removed on conduit.

Abbey ETNA Company

3422 MAPLEWOOD AVE., TOLEDO 10, OHIO

For more information on products advertised, use Inquiry Card, page 241

New Gorton 2-28 Brings You *Two* High-Efficiency Mills in *One* Money-Saving Unit



. . . as a horizontal mill.

The Gorton Receptor Ram makes the new 2-28 a true multi-purpose machine . . . "tailor-made" for *all* die-mold-machine shops. Consider the facts:

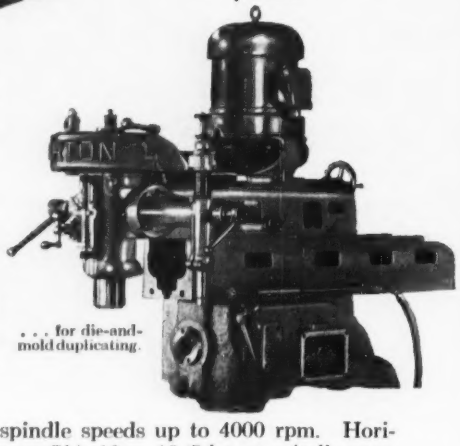
Gorton Exclusives . . . Yours in the 2-28

HORIZONTAL MILL

VERTICAL MILL (Super-speed)

DUPLICATOR (Simply add a duplicator head and a duplicator table.)

NOTE: You can switch from horizontal to vertical high-speed milling in 5 minutes or less. Save space and capital equipment — and increase production facilities at the same time.



. . . for die-and-mold duplicating.

- Fullwidth knee, 24½ inches wide, provides extreme rigidity. Even under heavy cutting loads, there's no sag or twist.
- New lubrication system dissipates heat to prevent spindle "growth" . . . to promote full use of spindle horsepower . . . to end the necessity for adjusting cutter depth to compensate for differences between "hot" and "cold" operation.
- High-speed head delivers spindle speeds up to 4000 rpm. Horizontal spindle: up to 2000 rpm — 7½, 10 or 10/5 hp *at spindle nose.*
- Double-extension feature of the Receptor Ram greatly increases work area, vertical capacity and transverse cutting capacity on either the Gorton 2-28 or 3-34 Horizontals.
- Down time and maintenance are drastically reduced by *true* unit construction features. A removable coolant pan speeds sump cleaning and coolant changing.
- Overload protection automatically safeguards expensive cutters. A horsepower-load meter constantly indicates cutter condition and operating efficiency.
- Full directional front and rear controls are interlocked.

You can't afford to overlook this Gorton Horizontal with Receptor Ram. It could produce more profit per dollar invested than any other machine you have. Fill out and mail the coupon.

GEORGE GORTON MACHINE CO.



1308 Racine St., Racine, Wis., U.S.A.

Please send at once Bulletin 1655-1308 and data on Gorton Horizontals.

Firm .....

Name .....

Title .....

Address .....

City, State .....

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429 Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich. (Thread)
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 1440 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
OK Tool Co., Milford, N. H.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Verner Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burs, Rotary

CUTTING COMPOUNDS

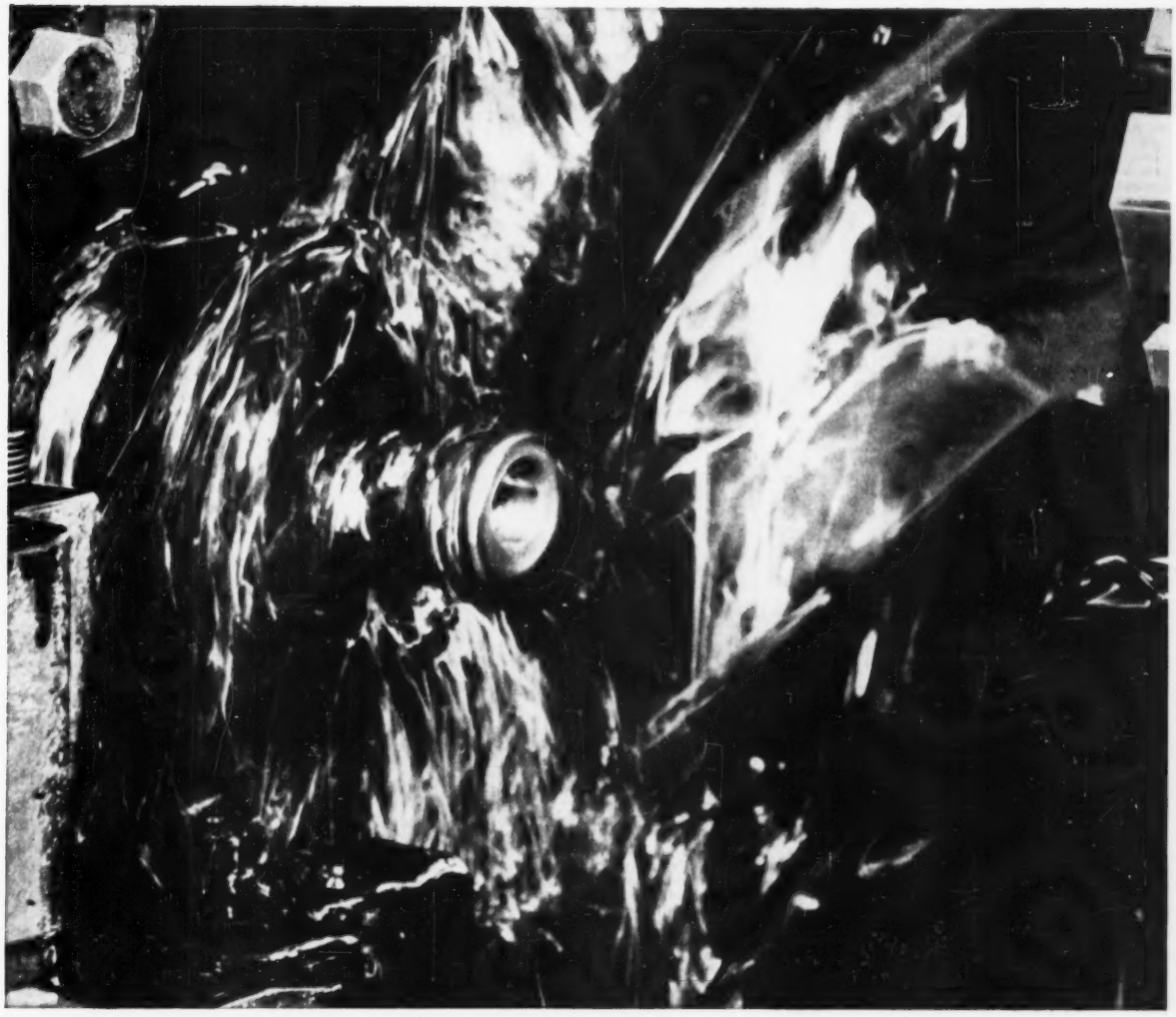
See Compounds, Cutting, Grinding, Etc.

CUTTING AND GRINDING FLUIDS

Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Master Chemical Corp., 13 Huron St., Toledo 1, Ohio.
National Refining Co., P.O. Box 6479, Cleveland 1, Ohio.
Shear-Speed Chemical Products, Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

(*Continued on page* 304)

For more information on products advertised, use Inquiry Card, page 241



What's Behind This Cutting Oil Picture?

Behind this cutting oil picture there's a story well worth telling . . . a story of 10 years' operation of the M. O. Devers Screw Machine Products Company.

During this time Devers has acquired and maintained a reputation for turning out the very highest quality precision machined parts and turning them out on time.

And during this same period, the oil that has helped Devers to achieve this enviable record is Cities Service Chillo #10 Cutting Oil. This one unusual oil has been used for work covering 1018, 1020, 4140, and stainless steel, and, says Devers official Harry E. McDaniel, "We have found it superior for all these machining operations."

For longer tool life, closer tolerances, and a simpler cutting operation, you—like the M. O. Devers Company—will find it profitable to investigate Cities Service Chillo Cutting Oils. Contact your nearest Cities Service representative or write Cities Service Oil Company, Sixty Wall Tower, New York 5, N.Y.

CITIES SERVICE
QUALITY PETROLEUM PRODUCTS

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Johnson Mfg. Co., Albion, Mich.
Landis Machine Co., Waynesboro, Pa. (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).

CUTTING-OFF MACHINES, Abrasive Wheel

Allison Co., Bridgeport, Conn.
Campbell Mch. Div., American Chain & Cable, 929 Conn. Ave., Bridgeport, Conn.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614 G. N. Lexington Ave., Pittsburgh 8, Pa.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

CUTTING-OFF MACHINES, Cold Saw

See Sewing Machines, Circular

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob, Inc., Grafton, Wis.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CUTTING-OFF WHEELS, Abrasive

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

CYLINDERS, Air

Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.

National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.

DEALERS, Machinery

Botwinik Bros. of Mass., Inc., 14 Sherman St., Worcester, Mass.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc. 2558 W. 16th St., Chicago 18, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Inc., Worcester, Mass.

DESIGNERS, Machine and Tool

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Hartford Specialty Mchry. Co., 287 Homestead St., Hartford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DIAMONDS AND DIAMOND TOOLS

Smit, J. K., & Sons, Inc., Murray Hill, N. J.

DIE-CASTING

See Castings, Die

DIE-CASTING MACHINES

Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DIEMAKERS' SUPPLIES

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES

Grob, Inc., Grafton, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Moumee St., Adrian, Mich.

DIE SETS, Standard

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

DIE-SINKING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St. Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.

DIE-SINKING PRESSES

Baldwin-Lima-Hamiliton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.

DIE STOCKS

See Stocks, Die

DIES, Sheet Metal, Etc.

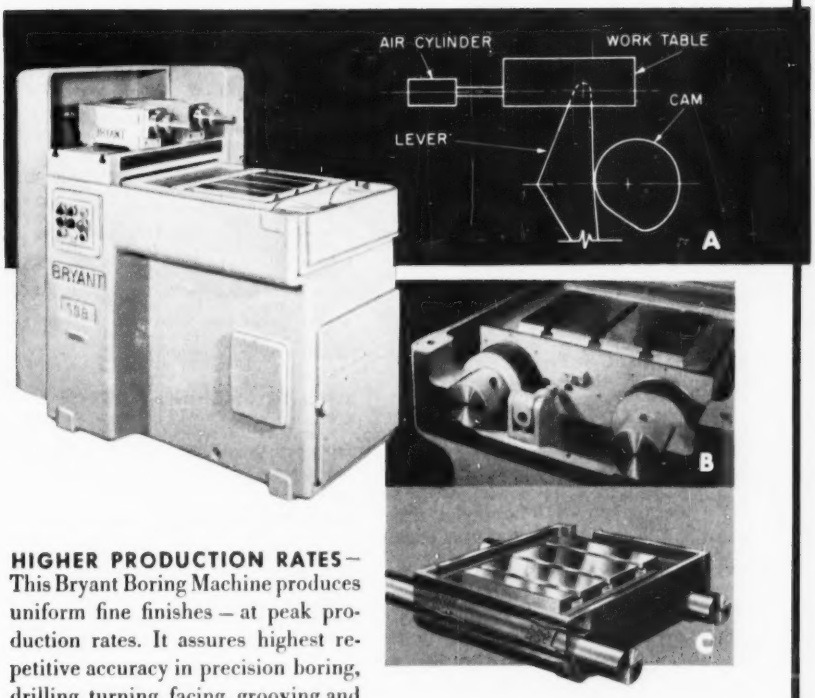
Allied Products Corp., 12677 Burt Rd., Detroit 23 Mich.
Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Carboloy Dept. General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krupp Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
John B., Manufacturing Co., Ellis St., New Britain, Conn.
Metal Carbides Corp., Youngstown, Ohio.
Niagara Mch. & Tool Wks. 683 Northland Ave., Buffalo, N. Y.
Richard Bros., Div. Allied Products Corp., 12619 Burt Rd., Detroit 23, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

DIES, Threading

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg., Mansfield, Mass.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Winter Bros. Co., Rochester, Mich.

(*Continued on page 306*)

A NEW APPROACH TO PRECISION BORING



HIGHER PRODUCTION RATES—This Bryant Boring Machine produces uniform fine finishes—at peak production rates. It assures highest repetitive accuracy in precision boring, drilling, turning, facing, grooving and contour boring and turning.

The table is actuated by a simple cam and lever unit **A** which provides positive control of the cycle at all times. This mechanical actuation eliminates variation in the cycle due to temperature change.

FINER FINISHES—The Bryant 998 provides the smooth, uniform table motion so essential in generating a fine finish with a single point tool. The table moves on two 4" diameter solid steel slide bars **B** firmly bolted to the bed. The table is supported by two anti-friction preloaded ball bearings on each of these bars. This construction provides a metal-to-metal contact which eliminates shifting due to an oil film **C**.

MINIMUM DOWN-TIME—The Bryant 998 requires minimum servicing—motors, boring heads and slides are permanently grease sealed. Every unit is easily accessible.

SPECIFICATIONS—Total table stroke: 6"; Top of table to top of bridge: 4"; Width of bridge: 27⅜"; Multiple boring heads as required by tooling to a maximum of 4 (209) heads; Boring head motor: 5HP; Table dimensions: 17½" x 22"; Floor space (without coolant tank): 31" x 54".

Write today for complete details!

BRYANT Chucking Grinder Co.
SPRINGFIELD, VERMONT, U. S. A.

Internal Grinders • Boring Machines
Internal & External Thread Gages • Granite Surface Plates

20 REASONS WHY...

- Bed, bridge, table and heads are normalized Meehanite castings.
- Cam actuated table moves on preloaded ball slide bars.
- Cam is hardened and ground.
- Boring head spindles rotate in preloaded ball bearings.
- Air cylinder opposes the work table motion directly with constant pressure and keeps the cam follower roll and the cam always in contact.
- Boring head drive is completely accessible.
- Cam drive assembly is protected by a torque limiting clutch.
- Cycle time is controlled by precision change gears in the cam drive gear box.
- Pad is provided at the rear for mounting accessory equipment.
- Push button controls are conveniently located.
- Manual, semi-automatic or fully automatic cycle.
- Emergency stop button instantaneously interrupts the cycle.
- Jog buttons on both front and rear of the machine for setup purposes.
- Machined setup pads are provided on the bridge for ease in locating fixtures.
- Maintenance is necessary at only three points: two grease fittings on the cam follower assembly and cleaning and filling of the filter-lubricator unit in the pneumatic system.
- Ball slide table is grease sealed.
- Gear box has its own closed lubrication system.
- Boring head bearings are permanently grease sealed.
- Cam is easily accessible for changing the table stroke.
- Change gears are enclosed in their own wet sump, splash lubrication system.

DIES, Threading, Opening

Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co. Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

DIES, Thread Rolling

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

DISCS, Abrasives

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.
Wolfs Sales Corp., 333 Nassau Ave. Brooklyn 22, N. Y.

DISINTEGRATORS

Elox Corp., 602 N. Rochester Rd., Clawson, Mich.

DIVIDING HEADS

See Indexing and Spacing Equipment

DOWELL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 N. Laural Ave., Des Plaines, Ill.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRAFTING MACHINES

Universial Drafting Mach. Corp., 7960 Lorain Ave., Cleveland, Ohio.

DRESSERS, Grinding Wheel

Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plains, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hoglund Engrg. & Mfg. Co., Inc., Berkeley Heights, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Meyers, W. F. Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.

DRIFTS, DRILL

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Etto Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Govro-Nelson Co., Detroit 8, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Keller Tool Co., Grand Haven, Mich.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STOPS

Wohlnip Engineering Co., 390 Hillside Ave., Hillside, N. J.

DRILLING MACHINES, Automatic

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros. Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Avey Drilling Mch. Co., 126 E. Third St., Covington, Ky.
Boice-Crane, 941 W. Central Ave., Toledo, Ohio.
Buffalo Forge Co., 490 Broadway, Buffalo.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Walker-Turner Div., Kearney & Treckar Corp., 900 North Ave., Plainfield, N. J.

DRILLING MACHINES, BOILER

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

DRILLING MACHINES, Deep Hole

Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.

DRILLING MACHINES, Gang

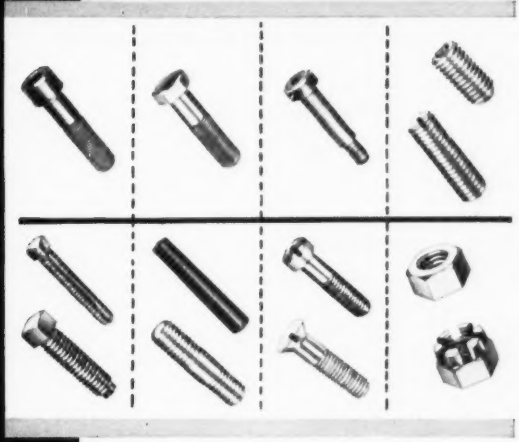
Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

DRILLING MACHINES, Horiz. Duplex

Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.

(*Continued on page 308*)

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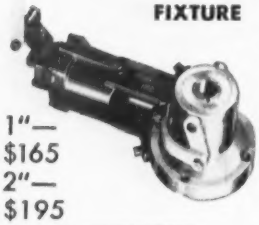
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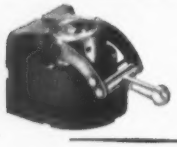
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Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DRILLING MACHINES, Horizontal Portable

Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Multiple Center Column Type

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

DRILLING MACHINES, Multiple Spindle

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool Mfg. Co., 3743 Durango Ave., Los Angeles 34, Cal.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry, Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foot-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kaukauna Machine Corp., Kaukauna, Wis.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

See Drilling Machines, Gang

DRILLING MACHINES, Sensitive

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Foot-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Upright

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Boice-Crane, 941 W. Central Ave., Toledo, Ohio.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Orban Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

(*Continued on page 314*)

National Tool Co.





Years of successful experience in special tooling and related production problems are yours for the asking. When the job requires special cutting tools call in your National Tool Co. representative. He is backed by more than 49 years experience in the engineering and manufacture of special cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

National Tools Cleveland

National

TOOL CO.

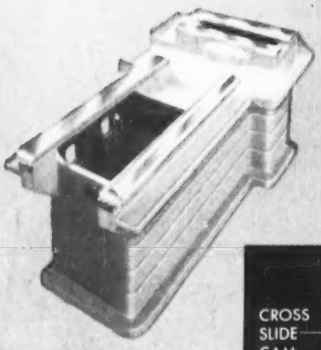
Cleveland 2, Ohio

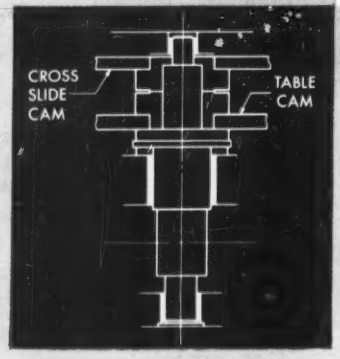


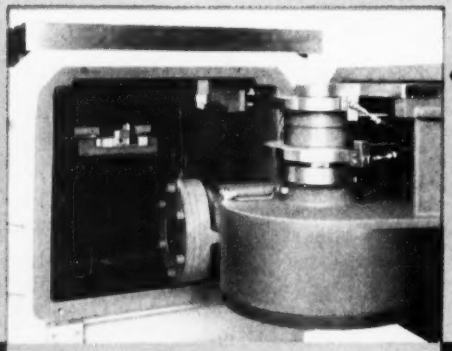
Flame Hardened Ways

Rugged — For Tough Jobs. The base is a heavily ribbed nickel iron casting.

Drawing shows the 3-bearing shaft which supports the cams.





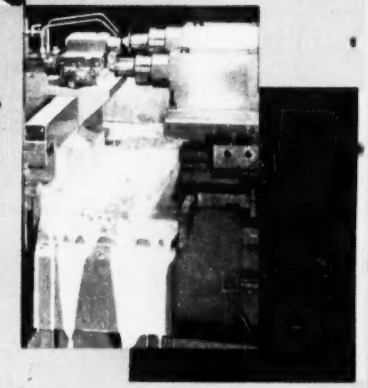


Cams Changed in *Minutes*

Just open the cam compartment and the cam assembly swings out for quick change of operation. All motors are outside the base.

Chip Problem Solved

Large chip chute is cast integral in the solid top of the base. There are no openings; chips or coolant cannot enter the base.



Direct Cam Action

★ NO LEVERS!

IN THE NEW STYLE 312 EX-CELL-O PRECISION BORING MACHINE

★ Fast

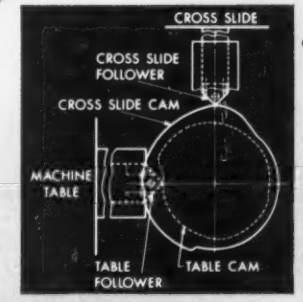
★ Accurate

★ Automatic

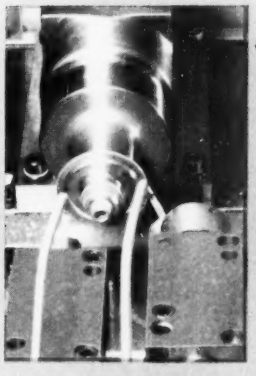
A New Method by EX-CELL-O

Direct Cam Action (NO LEVERS) for Sturdier Control

Added to Ex-Cell-O's line of Precision Boring Machines is the new Style 312, for precision contouring, boring, turning, facing and grooving operations.



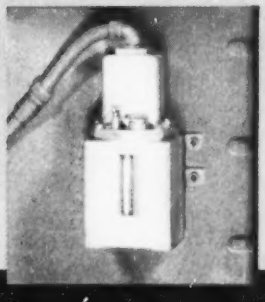
Drawing shows the contouring action. Note that cams act directly on the slides. THERE ARE NO LEVERS. There are separate cams for table and for cross slide, both being on one shaft to insure exact coordination.



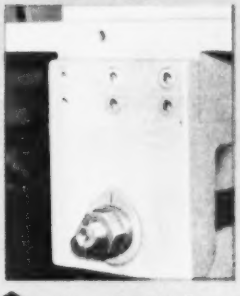
Close-up view of a two-tool contouring operation on an aircraft washer. The part is chucked on the spindle; tools are carried on the cross slide.



Spindle is lubricated permanently.



Ways are lubricated automatically by pump.



Size Control

Graduated adjustment, on end of machine, positions the table relative to the work.

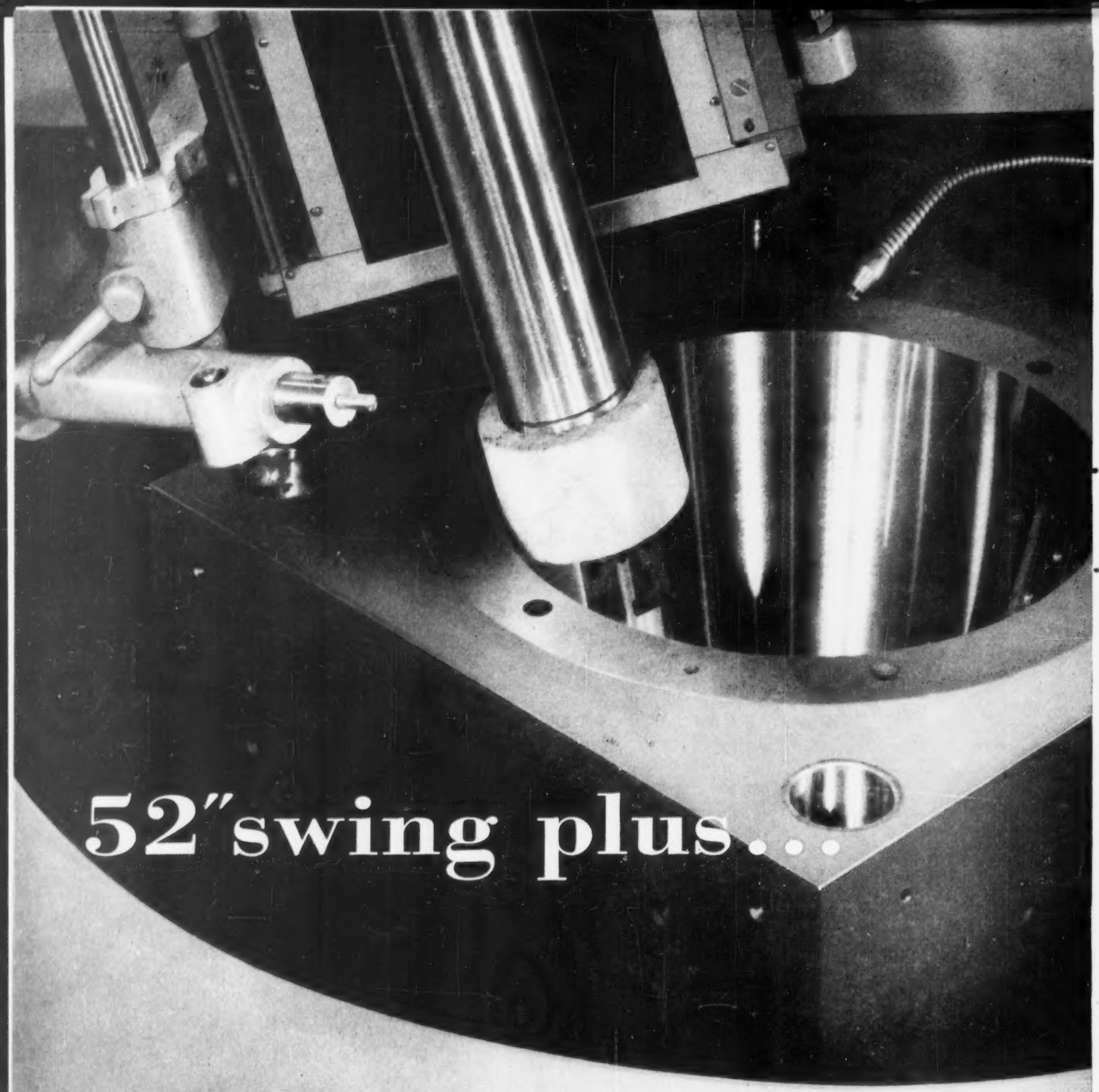
EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

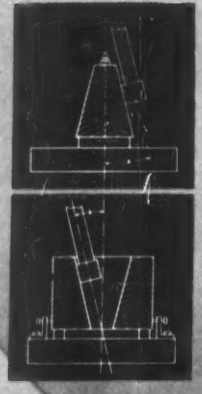
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54-43

FOR MORE INFORMATION . . . contact your Ex-Cell-O representative or write Ex-Cell-O in Detroit for literature.



52″ swing plus...

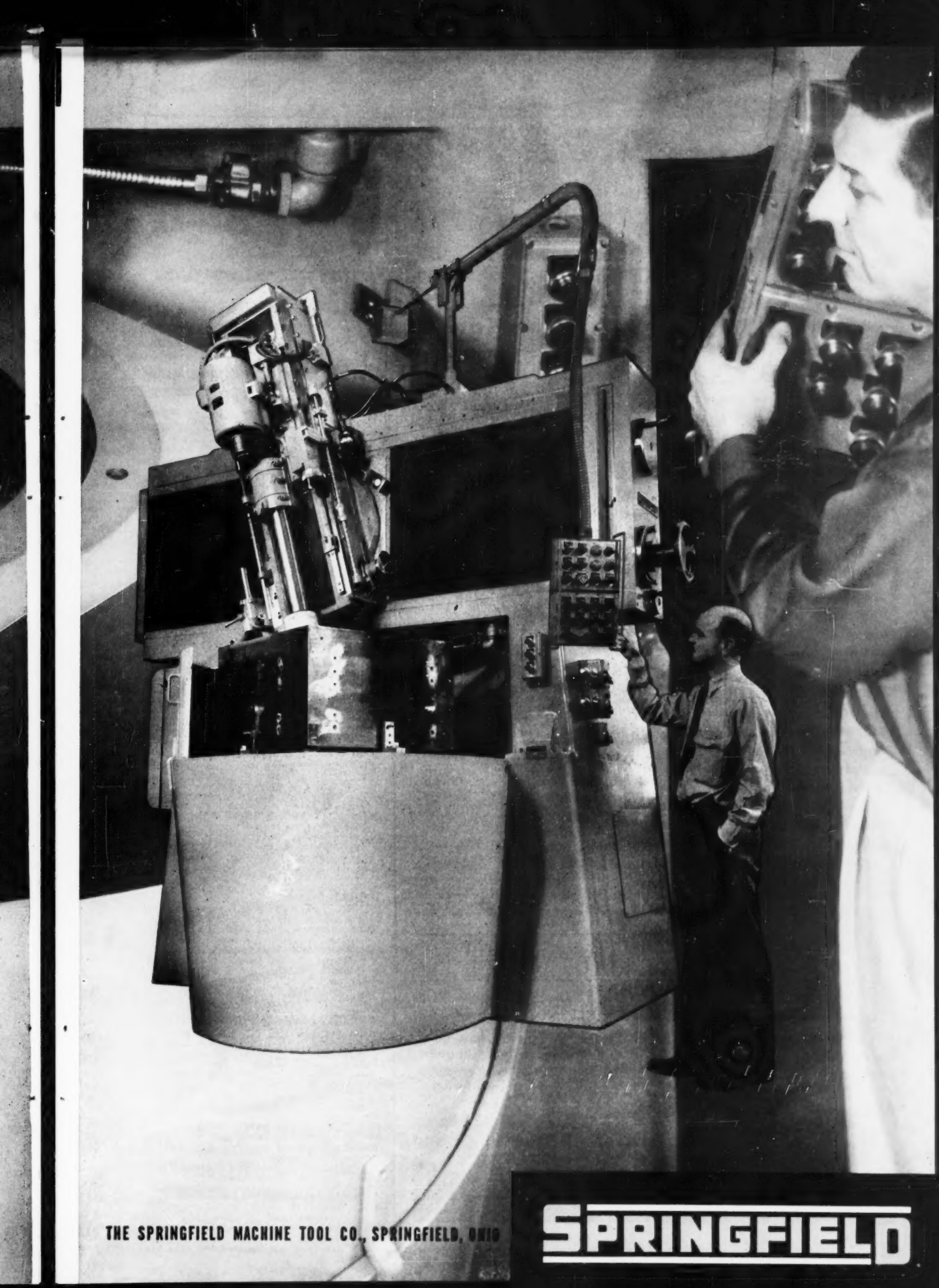


. . . plus up to 8″ more for the occasional out-size job . . . plus 27½″ grinding head stroke, 24¾″ clearance over face plate, 42″ diameter face plate — on Springfield's new Vertical Universal Grinder.

The work piece on the grinder here is a washing machine agitator mold, 43″ corner to corner. A tapered hole through it must match a conical male part (small illustration). One angle setting of the head ground both male and female taper for perfect fit. It had been planned to hand-lap them, a week's task. Springfield's time: 4½ hours.

Other Springfield Vertical Universal Grinders—swings 21″ and 30″.
Lathes—toolroom, engine, contouring, reproducing—14″ to 32″.
Write for name of nearest Springfield dealer.

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Universal Tool and Cutter Grinder



The ACE is EASY to operate because it requires no computation . . . the direct reading for clearances reduces fatigue, eases operators' jobs in grinding the most difficult cutters.

The ACE is SPEEDY because time lags are cut to the bone . . . the simplicity of design and operation make economy of motion and fast grinding certain with an Oliver.

The ACE gives you guaranteed PRECISION . . . handles a wider range of cutters than ordinary cutter grinders (includes high speed and tungsten-carbide work) —only two simple fixtures required.

The ACE also gives you unmatched ECONOMY through the efficiency witnessed in its unexcelled ease, speed and precision of operation. What is more, it is easy to set up, takes only a small amount of floor space and requires less outlay in dollars. Time proved, dependable and soundly engineered — the Oliver ACE Universal Tool and Cutter Grinder is built to give you many years of unsurpassed service.

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Direct Reading for Clearance
—Reduces Fatigue
—Eases Operators' Jobs

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Priced to meet your budget, the ACE excels for grinding face mills up to 15"—also, slab mills • slitting saws • dovetail cutters • angular cutters • double angle cutters • Fellows helical cutters • reamers • taper reamers • production gashing and carbide tipped circular saws.

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MACHINE TOOLS by OLIVER include:
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Snow Mfg. Co., 435 Eastern Ave., Bellwood Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

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Cleveland Punch & Shear Works., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS, Center

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McCosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd. Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DRILLS, Deep Hole

Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
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Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
Ryerson Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St. New York 9, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

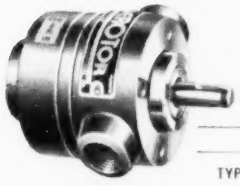
(*Continued on page 316*)

For more information on products advertised, use Inquiry Card, page 241

There's a Gerotor Hydraulic Pump

to meet your requirements!

The GEROTOR line of precision engineered hydraulic pumps is designed to fill the requirements of the majority of hydraulic equipment users. The three standard GEROTOR models cover a range of g.p.m. delivery from .4 g.p.m. to 40 g.p.m. Check the capacity tables for the pump to fill your needs.

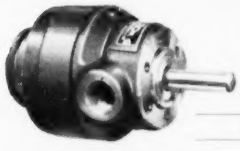


TYPE QDB

Gerotor's NEW QDB series of small capacity pumps . . . the last word in precision engineering.

Capacity Table

DELIVERY G.P.M. — 1800 R.P.M.					
TYPE	DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
QDB .4	.42	.40	.38	.35	.31
QDB .75	.84	.80	.78	.73	.66
QDB 1.5	1.67	1.62	1.57	1.50	1.42

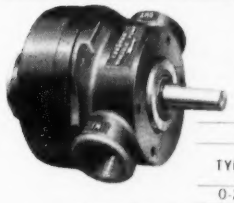


TYPE QDH

The QDH . . . popular intermediate size of the Gerotor line

Capacity Table

DELIVERY — G.P.M. AT 1200 R.P.M.							
TYPE	DISCHARGE PRESSURE P.S.I.						
	0	250	500	750	1000	1200	1500
QDH 3	3.3	3.2	3.1	3.0	2.9	2.7	2.5
QDH 5	5.6	5.4	5.3	5.2	5.1	4.8	4.4
QDH 8	8.6	8.5	8.4	8.3	8.2	8.1	7.8
QDH 12	12.9	12.8	12.7	12.5	12.3	12.2	11.8



TYPE O

Gerotor Series O . . . when larger capacities are needed

Capacity Table

DELIVERY — G.P.M. AT 1200 R.P.M.					
TYPE	DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
O-20	20.0	19.5	18.8	18.0	17.2
O-25	25.0	24.5	24.0	23.2	22.2
O-30	31.2	31.0	30.5	29.8	29.0
O-40	43.0	42.5	42.0	41.5	40.0

Whatever your needs in hydraulic pumps . . . consult the GEROTOR engineers. Write for FREE literature and information, no obligation, of course.

GEROTOR MAY CORPORATION
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Pneumatic Bin Evacuators — Precision Contract Manufacturing

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Get production off to a profitable start! Use Columbus Die-Tool engineered tools. Jigs, Fixtures, and Special Machinery individually designed and built to produce your product alone . . . at a rate to match your production schedule. That's production economy! That's the wisdom of CDT special machinery! That's how Columbus Die-Tool can put your production on a profitable basis. Columbus Die-Tool are specialists in building special tools, jigs, fixtures and machinery . . . have been for over 46 years. Talk over your special problems with us. Absolutely no obligation. Write today.

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist
Besley-Welles Corp., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, III.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, III.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago III.
Greenfield Tap & Die Corp. Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRIVES, Chain
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

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Gorton, George, Mch. Co. 1110 W. 13th St., Racine, Wis.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Richford Mch. Tool Co., 2500 Kishwaukee St., Rockford, III.

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Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS
Pangborn Corp., Hagerstown, Md.

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EMERY WHEELS
See Grinding Wheels

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Gorton Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

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Wohlnip Engineering Co., 390 Hillside Ave., Hillside, N. J.

EXTRACTORS, Screw
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Greenfield Tap & Die Corp., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

FACING MACHINES
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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

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General Electric Co., Schenectady 5, N. Y.

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FELT, For All Applications
American Felt Co., Glenville, Conn.

FILES, Hack
DoAll Co., 254 Laural Ave., Des Plaines, III.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand
DoAll Co., 254 Laurel Ave., Des Plaines, III.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

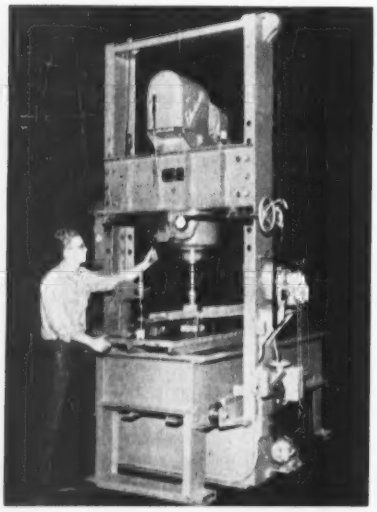
FILES Machine
DoAll Co., 254 Laurel Ave., Des Plaines, III.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary
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Jarvis, Chas. L., Co., Middletown, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

(Continued on page 320)

When the mountain wouldn't come to Mohammed





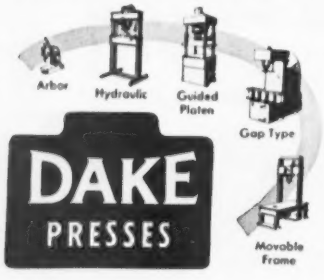
Tradition says that the mountain didn't come when Mohammed commanded, so he resolved the situation by going to the mountain.

The same strategy makes the Dake Movable Frame Press unique among presses. Instead of moving the work under the press, the press is moved over the work. The frame moves longitudinally and the work-head moves laterally or vertically to any position over the worktable.

The advantages of this arrangement are many. For example, at left a Dake Movable Frame Press is used for straightening aircraft forgings. Once the forging is mounted on supports, and gauges have been placed, pressure can be applied at any desired point without disturbing the setup.

Support points can be spread to the extreme edges of the large table for work on long or irregularly shaped pieces. Work too heavy or awkward to handle manually, can be set on the table with an overhead crane, and the press moved into position.

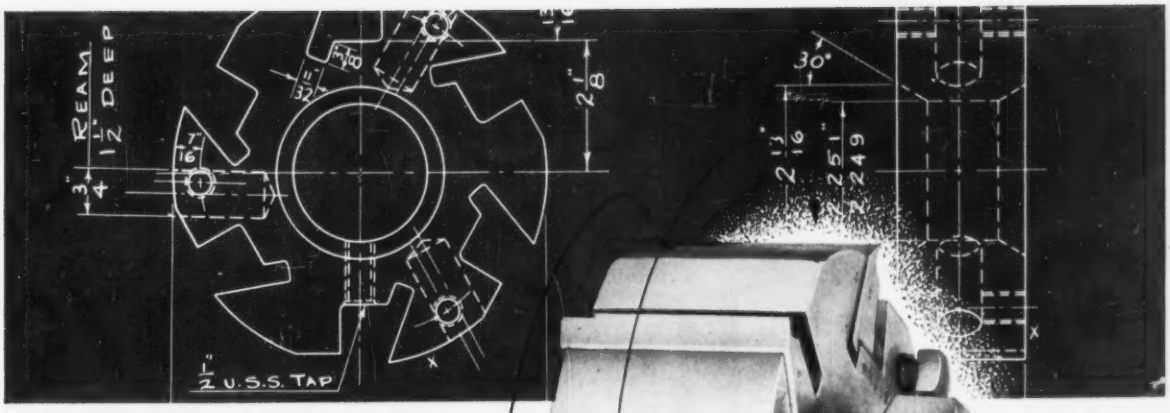
Dake movable frame hydraulic presses can be electric or air powered, and are availble in 25- to 300-ton capacities. Write for Bulletin No. 269.



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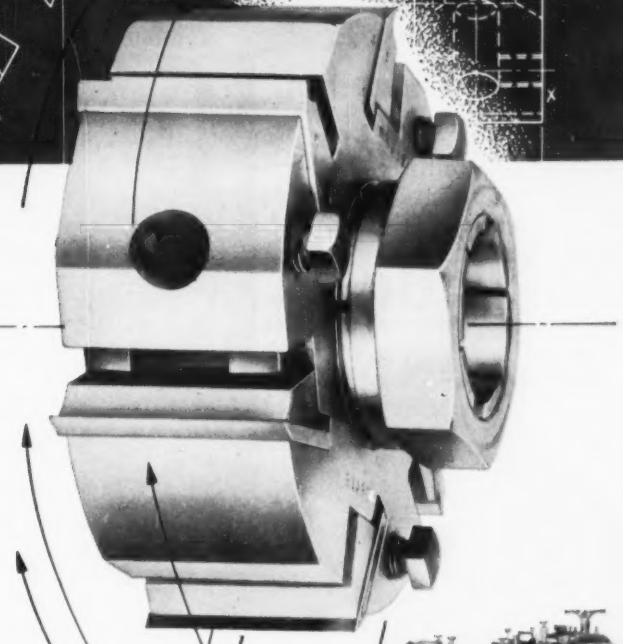
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Address_____
City_____ Zone____ State_____

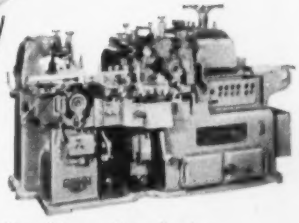
For more information on products advertised, use Inquiry Card, page 241



MAX-EL

alloy steel cutter head
for high-speed
electric moulder
finish-machined
after
heat treatment





You're looking at the "firing line" part of Mattison Machine Works' No. 276 High-Speed Electric Moulder. For this cutter head holds six knives that travel at up to 7200 rpm to do the machine's work of fast, vibration-free woodworking.

Hot-rolled Crucible MAX-EL® 3½ was chosen for this vital part. The forged and annealed MAX-EL blank is rough machined, then heat treated to 26-30 Rockwell "C" – *and then finish-machined.*

The remarkable machinability of MAX-EL after heat treatment...its dimensional stability...and its uniformity, which permits heat treating to a very close range of hardness – these characteristics make MAX-EL an ideal choice for vital machine components such as this cutter head.

But try MAX-EL in your own shop. You'll see for yourself how these outstanding properties mean *faster* machining...*fewer* rejects ...*longer* tool life. On your next order for alloy steel – include MAX-EL. For immediate delivery – *call Crucible.*



54 years of Fine steelmaking

CRUCIBLE first name in special purpose steels

ALLOY STEELS

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

Branch Offices and Warehouses: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DAYTON DENVER • DETROIT • HOUSTON • INDIANAPOLIS • LOS ANGELES • MILWAUKEE • NEWARK • NEW HAVEN • NEW YORK • PHILADELPHIA • PITTSBURGH PROVIDENCE • ROCKFORD • SAN FRANCISCO • SEATTLE • SPRINGFIELD, MASS. • ST. LOUIS • ST. PAUL • SYRACUSE • TORONTO, ONT. • WASHINGTON, D. C.

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

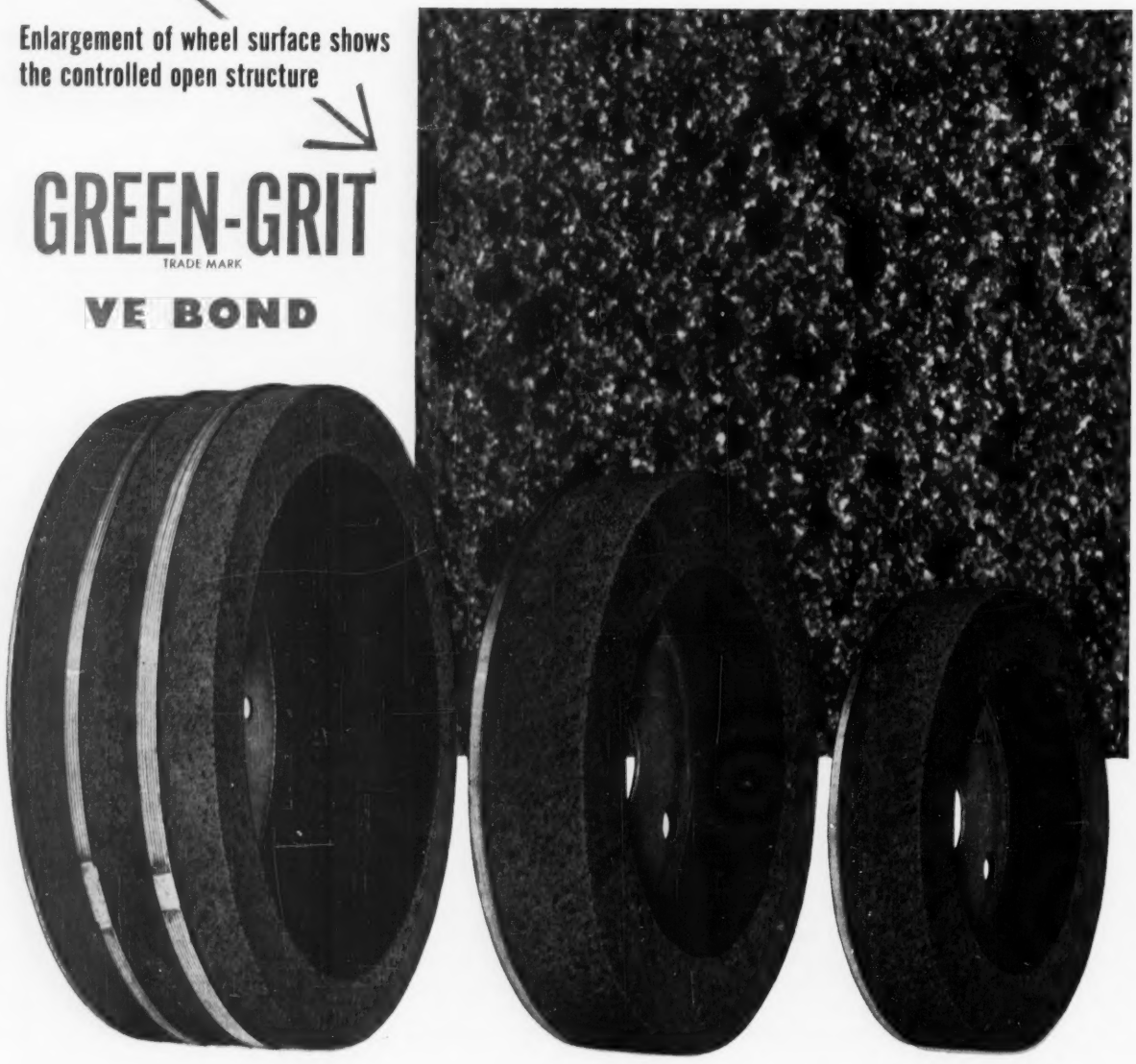
For more information on these products, use Inquiry Card, page 241

NEW LARGE PORE

Enlargement of wheel surface shows the controlled open structure

GREEN-GRIT
TRADE MARK

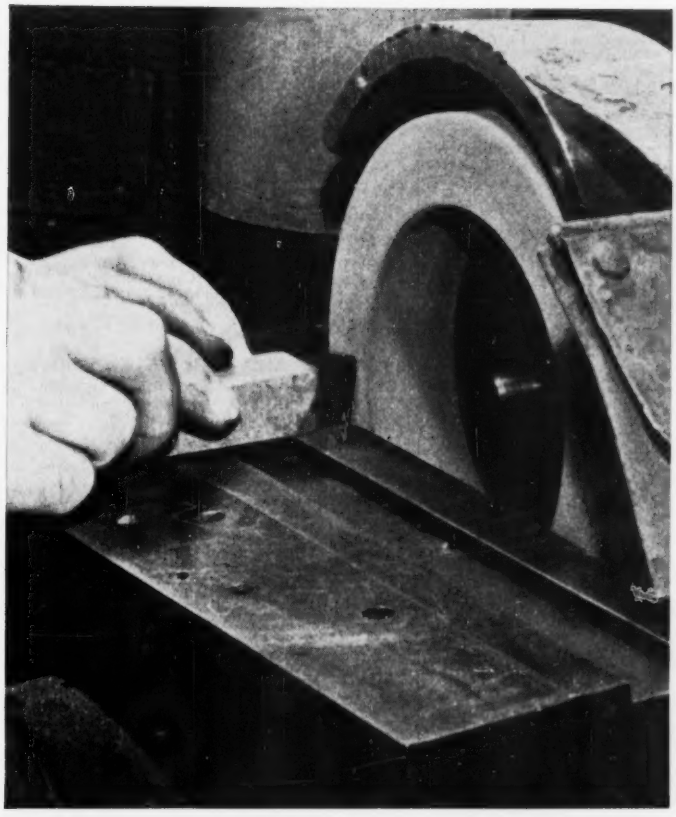
VE BOND



SEE YOUR CARBORUNDUM DISTRIBUTOR FOR FULL DETAILS He's listed in the yellow pages under "Abrasives" or "Grinding Wheels"

...continually putting more sense in your abrasive dollar

WHEELS for carbide grinding



Cool, fast cutting—plus long wheel life: these are the features most liked by users of CARBORUNDUM's new series of GREEN-GRIT open-pore 12 Structure VE Bond Wheels for grinding of cemented carbides. Here are some typical comments.

"**Less heat is right!** These new wheels surprised us on that score. We rough our tools faster, get more tools per wheel—and have eliminated heating and checking of tools."

"**We find we can grind all types** of carbide with one grading of your new GREEN-GRIT Wheel. What's more, we use them right down to the steel backs—that new cement does the trick!"

"**Glazes less** than any other wheel we have tried. The open pores provide better chip clearance, as well as cooler cutting qualities."

"**We use one grade softer** with your new wheel...get faster cutting and still get longer life."

GREEN-GRIT large pore wheels are available in a complete range of grits and grades. Why not order one for trial today?

Send for this

FREE BOOKLET

on carbide grinding ... plus folder on new GREEN-GRIT Wheels.



THE CARBORUNDUM COMPANY
Niagara Falls, New York, Dept. M 81-411

"I'd like your booklet, *"Grinding Cemented Carbides"* and the folder on your new open structure wheels.

NAME _____ TITLE _____

COMPANY _____

STREET AND NUMBER _____

CITY _____ ZONE _____ STATE _____

CARBORUNDUM

REGISTERED TRADE MARK

81-411

FILING MACHINES, Dies, Etc.
Boice-Crane, 941 W. Central Ave., Toledo, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Grob, Inc., Grafton, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Air
Keller Tool Co., Grand Haven, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Cuno Engrg. Corp., Meriden, Conn.
Industrial Filtration Co. (Delpark Corp.) 15 Industrial Ave., Lebanon, Ind.

FINISHES FOR MACHINES AND METAL PARTS
Lowe Bros. Co., Dayton, Ohio.

FLEXIBLE COUPLINGS
See Couplings, Flexible

FLEXIBLE SHAFT EQUIPMENT
Jarvis Chas. L., Co., Middletown, Conn.
Orban, Kurt, Co., Inc. 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney West Hartford 1, Conn.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

FORGINGS, (Upsetting) Machines
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

FORGINGS, Drop
Bethlehem Steel Co. Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
Cameron Iron Works, Inc., 1000 Silber Rd., Houston, Texas.
Morgan Engrg. Co., Alliance, Ohio.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Wyman-Gordon, Madison & Gob Sts., Worcester 1, Mass.

FORGINGS, Upset
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING AND BENDING MACHINES
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hufford Machine Works, Inc., (Stretch-wrap), 1700 E. Grand Ave., El Segundo, Calif.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

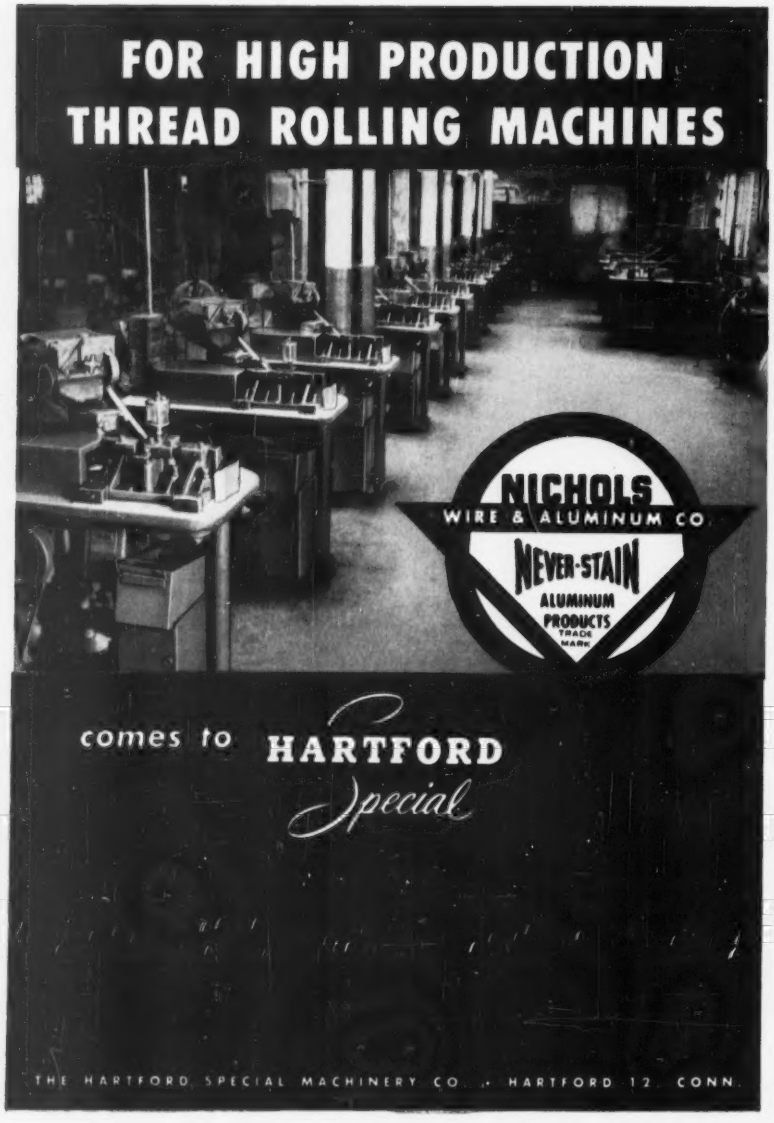
FORMING AND STAMPING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FORMING TOOLS or Tool Blanks
Brown & Sharpe Mfg. Co., Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded
Mahon, R. H. Co., Detroit 34, Mich.

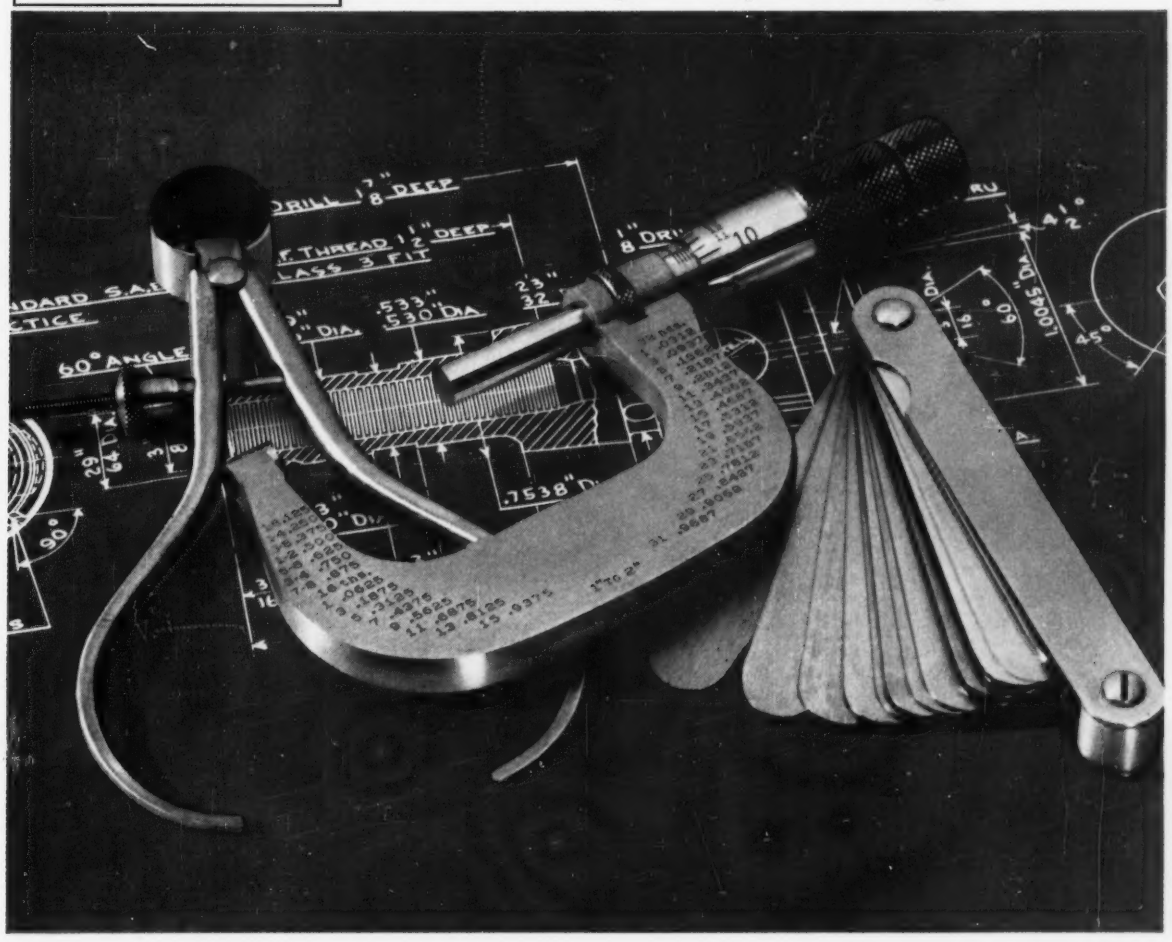
FURNACES, Heat-Treating
General Electric Co., Schenectady 5, N. Y.

(Continued on page 322)



For more information on products advertised, use Inquiry Card, page 241

ANTISEP —the heavy-duty cutting base



When close tolerances are a must, you need

ANTISEP

When you're working to close tolerances, Antisep again proves it has the qualities that make it the leader in the field of cutting fluids.

This heavy-duty, fortified cutting base—soluble in water—provides greater lubricity and carries heat away faster than any cutting fluid you can match against it.

Tools stay sharper and last longer with Antisep. Work comes off with minimum distortion cool enough to handle barehanded. And Antisep also has topnotch anti-welding properties that mean freedom from chip build-up on the tool and better finish on the parts.

Try Antisep. Ask the Houghton Man to arrange a trial production run—or write to E. F. Houghton & Co., 303 W. Lehigh Avenue, Philadelphia 33, Pa., for further information.

ANTISEP
the heavy-duty, water-soluble
CUTTING BASE

a product of . . .

E. F. HOUGHTON & CO.
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO



Ready to give you on-the-job service . . .

For more information on these products, use Inquiry Card, page 241

FURNITURE, Shop
Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc. 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

GAGES, Air
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Comparator
Alina Corp., 401 Broadway, New York 13, N.Y.
Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Ames, B. C., Co., Waltham 54, Mass.
Baptist Machine Co.. Inc., 36 Ludlow St., Stamford, Conn.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St. New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth
Ames, B. C., Co., (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Dial
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co. Inc. 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket R. I.

GAGES, Electric
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027 Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GAGES, Height
Amco Gage Co., 19760 W. 8 Mile Rd. Detroit 19, Mich.
Ames, B. C., Co., Waltham 54 Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp. 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol Mass.

GAGES, Plug, Ring and Snap
Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Scher., George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp. 721 Springfield, Dayton, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co. Athol Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros. Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

(*Continued on page 326*)



COMPARE

... PRICE! ... FEATURES! ... PERFORMANCE!



GREAVES

... WILL BE YOUR CHOICE!

WRITE FOR YOUR COPY OF THIS EYE-OPENING COMPARISON CHART

ASK ABOUT OUR TOOL LEASE AND DEFERRED PAYMENT PLANS

"The Most Mill For The Least Money"

Now you can make the same painstaking comparison that sold and satisfied leading plants on Greaves 2H plain and universal milling machines. A free chart cross-compares 22 significant specifications . . . including speeds, feeds, power and capacity . . . on each of the eight leading milling machines.

Make your own comparison . . . in your office, out on the factory floor or right out of our competitors' catalogs . . . we're convinced you'll find that Greaves is your best buy!

GREAVES MACHINE TOOL COMPANY, 2500 EASTERN AVE., CINCINNATI 2, OHIO

Please send me: ☐ The COMPARISON CHART.
☐ Tool Lease and Deferred Payment Plans.

Name_____

Title_____

Firm_____

Address_____ City_____ Zone____ State____

For more information on products advertised, use Inquiry Card, page 241



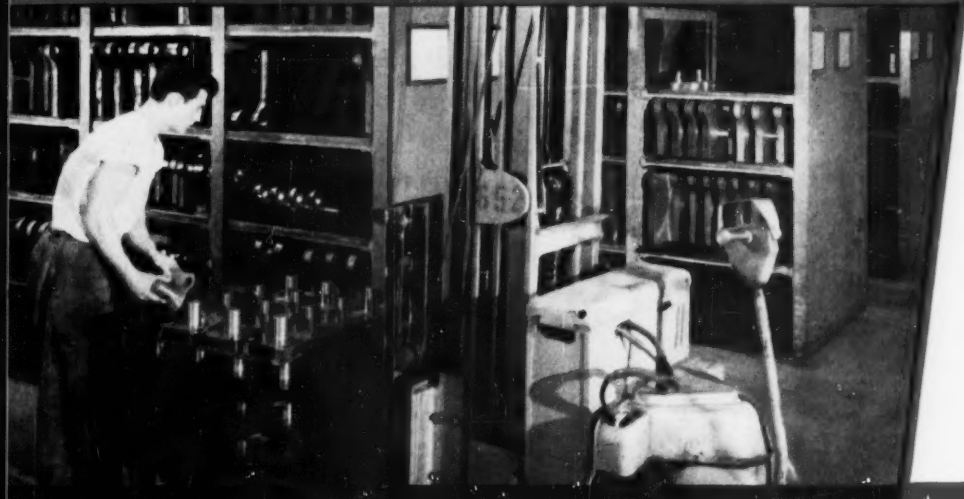
At Danly's Chicago Plant . . . final broaching to assure accurate sizing and parallelism of guide post and bushing holes

World's fastest die set service speeds up your tooling program

Mass production plus local stock means faster delivery

DANLY

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue
Chicago 50, Illinois



At a Danly Branch Plant . . . complete stocks of die set components ready for assembly to your order

*CHICAGO 50
2100 South Laramie Avenue
*CLEVELAND 14
1550 East 33rd Street
*DAYTON 7
3196 Delphos Avenue
*DETROIT 16
1549 Temple Avenue
*GRAND RAPIDS
113 Michigan Street N.W.
INDIANAPOLIS 4
5 West 10th Street
*LONG ISLAND CITY 1
47-28 37th Street

FAST, NATIONWIDE DELIVERY FROM THESE BRANCHES

Danly's new, faster service starts at the main Danly Plant in Chicago where two unique, high-speed, mass production lines are devoted exclusively to the manufacture of interchangeable, precision die set parts. Stocked by Danly Branch Plants in major toolmaking centers, these interchangeable parts are quickly assembled to make up the size and type of die set you need—and delivered to you only a few days after your order is received. Make a note right now of the Danly Branch nearest you from the list given on this page. Next time you need die sets, give your Danly Branch a call. See how they can meet your needs from stock . . . and save you time with fast, local service.

*LOS ANGELES 54
Ducommun Metals & Supply Co.
4890 South Alameda
MILWAUKEE 2
111 East Wisconsin Avenue
*PHILADELPHIA 40
511 W. Courtland Street
*ROCHESTER 6
33 Rutter Street

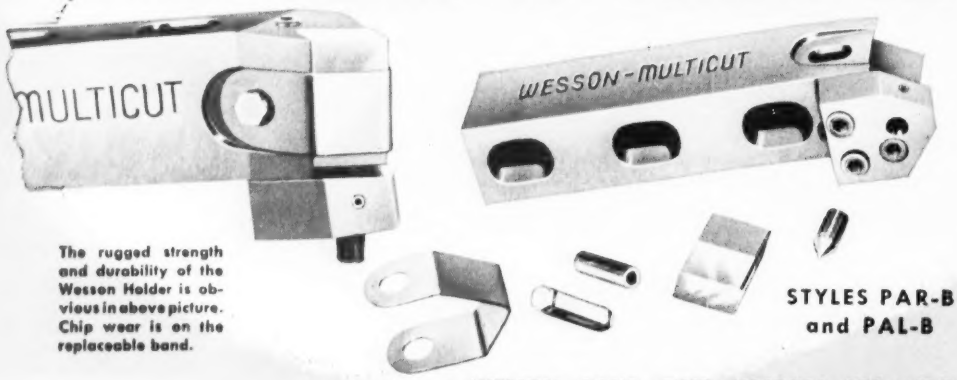
Indicates complete stock

Combine WESSON TOOL ENGINEERING SKILL and EXPERIEN

Our 30th Year In Carbide!

This New WESSON Engineere TOOL HOLDER

ROUGH TURNS HOT FORGED 155 MM SHELLS



The rugged strength and durability of the Wesson Holder is obvious in above picture. Chip wear is on the replaceable band.

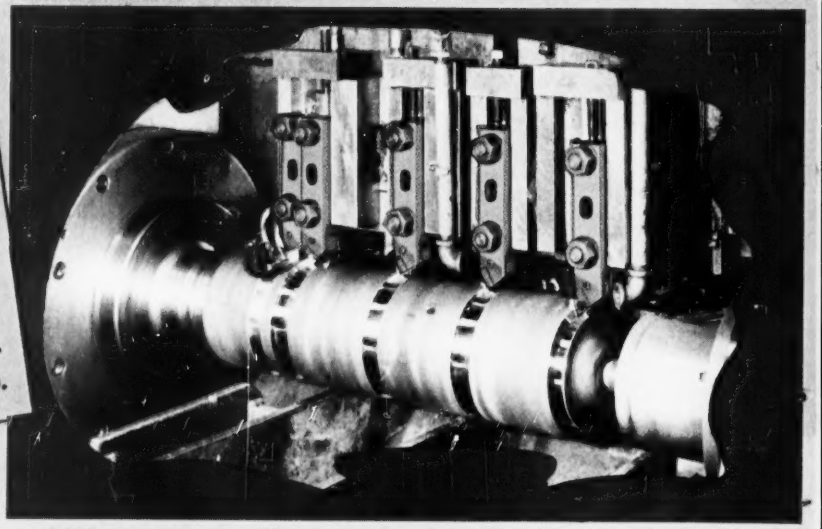
STYLES PAR-B and PAL-B

WESSON MULTICUT PARALLELOGRAM BAND TYPE HOLDER

WESSON BAND TYPE HOLDERS ARE VIRTUALLY INDESTRUCTIBLE EVEN UNDER ABNORMAL CONDITIONS. THE STEEL BAND IS REPLACEABLE AT VERY LOW COST. 101 DIFFERENT STANDARD STYLES AND SIZES ARE AVAILABLE.

ACTUAL JOB SETUP NOW AT A LARGE SHELL MANUFACTURING CO.

Part.....155 MM hot forged shell.
Operation.....Rough turning.
Machine..Burleigh Stacker Hydra-Feed automatic lathe.
Tools.....5 Wesson Multicut Band Type Parallelogram Tool Holders with Parallelogram Wesson-metal insert grade WM.
Depth of cut.....Up to 1" maximum.
Feed.....032 per revolution.
S.F.M.....320.



This photo, taken while the machine was running shows the depth of cut and type of finish obtained by rough turning with Wesson Holders and Wesson-metal insert. Note extra holder strength possible with the parallelogram insert. The lead angle is 25°.

The Wesson Tool Engineer in your area has full details on this job. Ask him about Case History #135.

WESSON COMPANY

1220 WOODWARD HEIGHTS BLVD. FERNDALE (DETROIT 20), MICH.

with WESSONMETAL HIGH PERFORMANCE *for Increased Production . . .*

And *This*

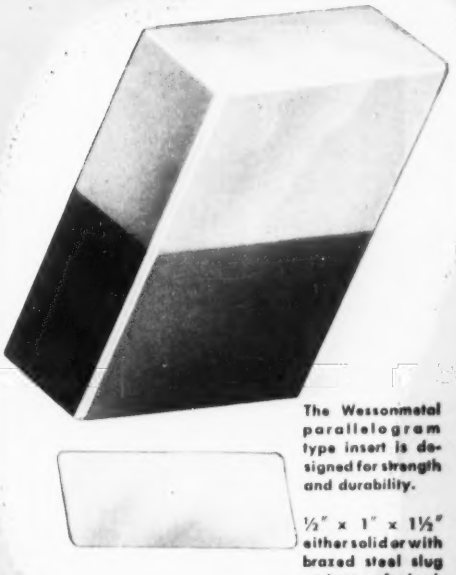
WESSONMETAL INSERT

WITH CUTS UP TO 1" DEEP!

Another FIRST for WESSON

with Tool Costs Reduced by Over 60%
Production Increased 400%

OLD METHOD	NEW WESSON METHOD
Tool Cost.....$37.50	Tool Cost.....$50.00
Useable Carbide.....3/8"	Useable Carbide.....5/16"
Average Pieces per Grind...60	Average Pieces per Grind...60
Pieces Machined per Tool..420	Pieces Machined per Tool..1680
Tool Cost per Piece.....8.1c	Tool Cost per Piece.....2.9c
Down Time for Tool Change... 15 min. every hour	Down Time for Tool Change... 4 min. every hour



The Wessonmetal parallelogram type insert is designed for strength and durability.

½" x 1" x 1½" either solid or with brazed steel slug on bottom for back up screw contact.

WESSONMETAL IS OUTSTANDING FOR HIGH PERFORMANCE BECAUSE IT IS UNIFORMLY DEPENDABLE IN QUALITY

WESSONMETAL *is available in 8 grades for all types of metal working.*



SEE THE DRAMATIC STORY OF CARBIDE in Sound and Color "THIS CARBIDE AGE" There's a Wesson Tool Engineer in your area who will give you full details about this fine educational movie. Call him or write.

WESSON METAL CORPORATION

LEXINGTON 34, KENTUCKY

GAGES, Surface

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol Mass.

GAGES, Taper

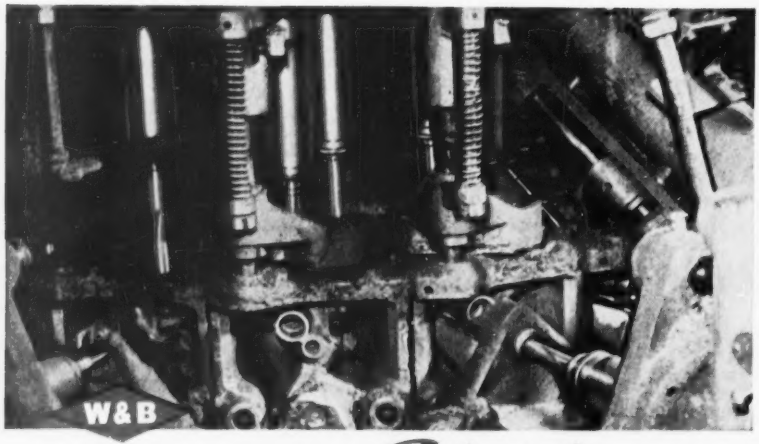
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co. 22038 Beech St., Dearborn, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Iroquois Corp., RFD 4 Box 331, 1800 E. 11 Mile Rd., Royal Oak, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

GASKETS

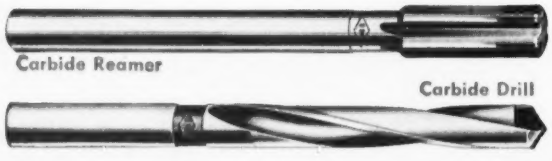
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.



Carbide Drills Selected For Long-Life and Increased Production

Illustrated above is a fifteen station vertical automatic indexing machine using sixteen Whitman & Barnes carbide drills ranging from ¼" to 9/16" diameter, two carbide core drills and one carbide reamer. Simultaneous vertical, horizontal and angular drilling of oil pump bodies is done on this machine.

This large manufacturer of automobiles selected W & B carbide drills as a means for increasing production of these cast iron oil pump bodies. Because W & B carbide drills have extra-long-life and provide more holes per grind, his drilling cost is reduced, there are fewer shut-downs for changing drills and maximum production time is obtained from each machine.



W&B

YOUR INDUSTRIAL DISTRIBUTOR
Can Give You Quick Service
On Whitman & Barnes Tools.
Contact Him Today!



WHITMAN & BARNES
40040 PLYMOUTH ROAD • PLYMOUTH, MICH.
NEW YORK • CHICAGO • LOS ANGELES • ATLANTA

GEAR BLANKS, Non-Metallic

Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
General Electric Co., Schenectady 5, N. Y.

GEAR BURNISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, SPUR and Helical Gears (Hobbing)

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.

(Continued on page 328)

For more information on products advertised, use Inquiry Card, page 241



...another MORRIS MOR-SPEED production machine

OPERATIONAL CYCLE:

Station	1	Load and Unload
Station	2	Drill two 57/64" holes Drill four 29/32" holes
Station	3	Spot face six holes
Station	4	Ream (.9062") two holes

Drilling six large holes in armor plate forgings is no cinch, but when you want a finished part every minute and twenty seconds, that's a tough problem. To Morris Engineers, it was a familiar problem... precision drilling on a mass production basis!

The machine furnished was a MOR-SPEED Four Station Vertical, giving "special machine" production and precision at remarkably low cost. Standard base, rear column, indexing table, slide and hydraulic feed mechanism are combined with special multiple drilling head and work fixtures . . . to make up this high production machine.

Consider the savings . . . investment, labor, time and floor space . . . offered by Morris MOR-SPEED Machines. Precision high production can be yours for less than you might imagine!

Morris

946 HARRIET STREET CINCINNATI 3, OHIO

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR GRINDING MACHINES

Cosa Corp. 405 Lexington Ave., New York 17.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., Springfield, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 Rover St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers.

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, CUT

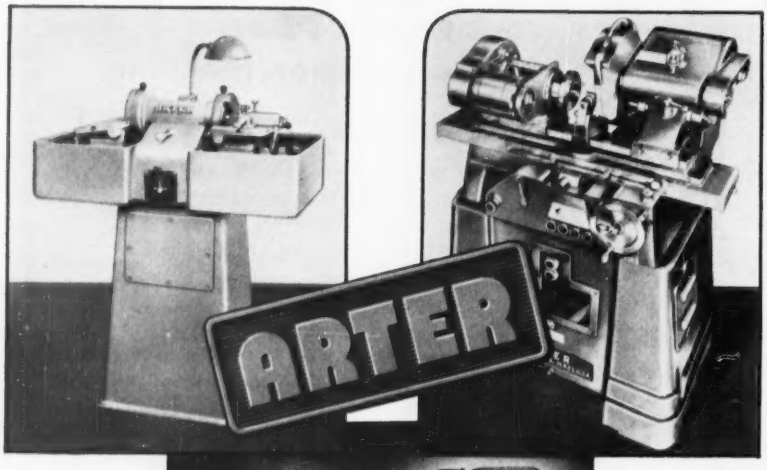
Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Miemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Franke Gear Works, Inc., 1924 W. Columbia Ave., Chicago 26, Ill.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 13, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Ohio Gear Co., 1333 E. 179th St., Cleveland.
Perkins Machine & Gear Co., West Springfield, Mass.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Williamson Gear & Mcchine Co., 2606 Martha St., Philadelphia 25, Pa.

GEARS, Rawhide and Non-Metallic

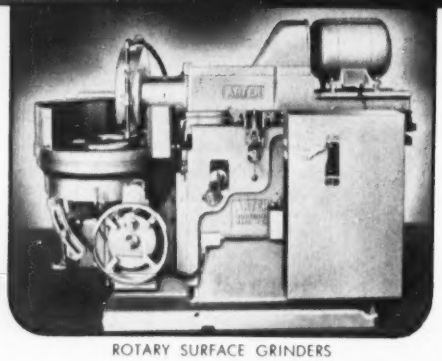
Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.

(*Continued on page 330*)

The Arter Family of Machines



CARBIDE TOOL GRINDERS



CYLINDRICAL GRINDERS

INTERNAL GRINDERS

ROTARY SURFACE GRINDERS

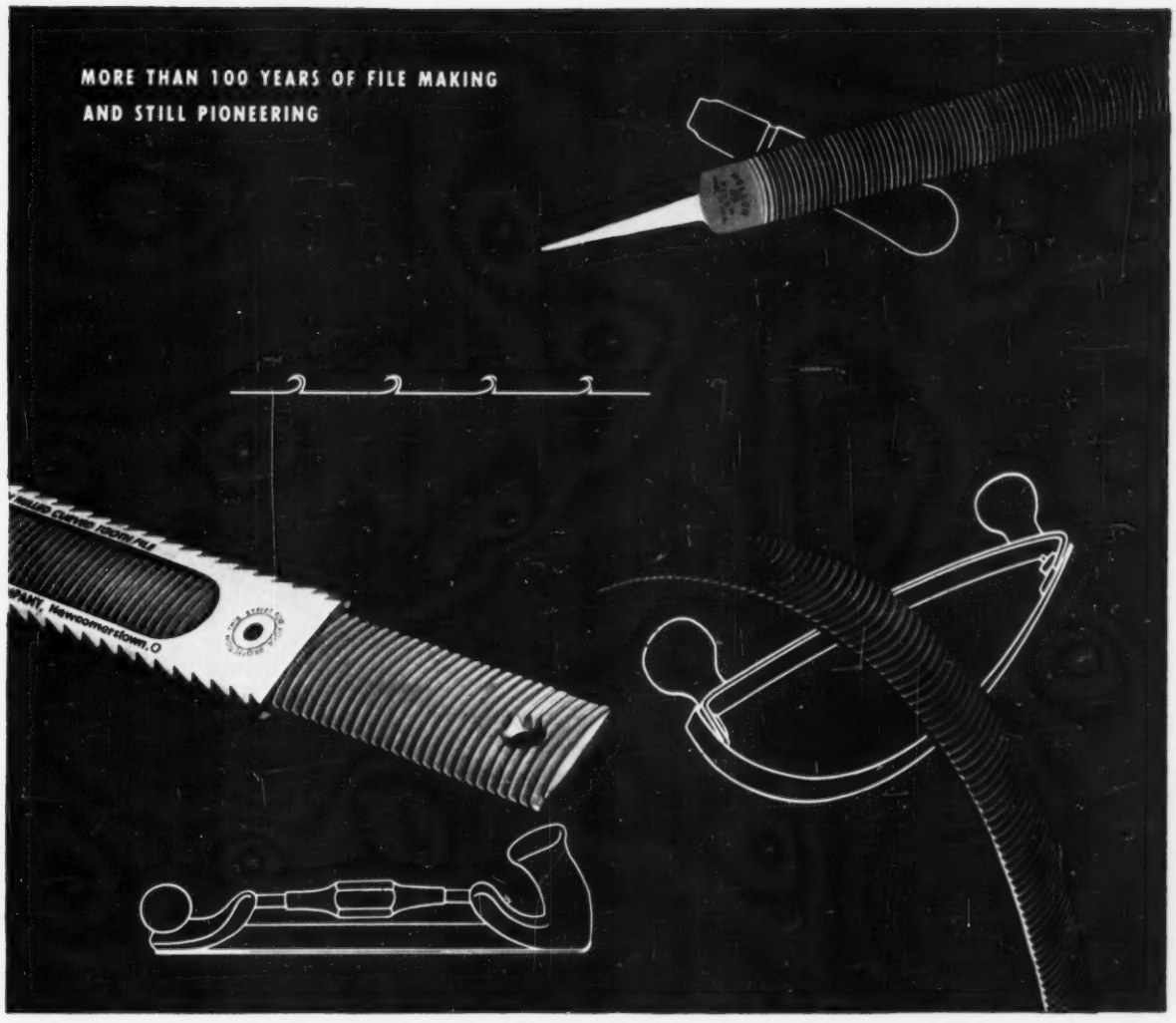
The Arter trademark on these machines is the sign of ACCURACY • POWER • DEPENDABILITY. Tell our engineers your grinding problems. They'll find a way to lick them.

ARTER GRINDING MACHINE COMPANY

WORCESTER · MASSACHUSETTS

Agents in industrial centers of United States and Canada

For more information on products advertised, use Inquiry Card, page 241



HELLER WAS FIRST WITH *VIXEN** MILLED CURVED-TOOTH FILES

Originated by Heller Brothers over 35 years ago, the Vixen still stands as the greatest single improvement ever made in metal finishing files. Each curved-tooth is actually a miniature milling cutter. Vixen cuts faster, freer, finishes smoother. File clears easily even when used on soft, non-ferrous metals or fibrous materials. Famous Vixen is only one of many Heller contributions to better filing. Over a century of continuous inspecting, testing and improving guarantees users of Heller files "the best."

other Heller *Firsts*

NUCUT* Wavy-Teeth Files
SPIRAL-CUT Half Round Files
WAVY-TEETH* Double Cut Mill and Saw Files

*Registered T.M.

VIXEN
American-Swiss
NUCUT

THESE 3 FAMOUS BRANDS ARE MADE ONLY BY

HELLER BROTHERS TRADE MARK SINCE 1836

HELLER BROTHERS CO. *America's Oldest File Manufacturer* **NEWCOMERSTOWN, OHIO**

YOUR *HELLER* DISTRIBUTOR CAN SUPPLY ALL YOUR FILE NEEDS

Cincinnati Gear Co., Wooster Pike and Marie-mont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ohio Gear Co., 1333 E. 179th St., Cleveland.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

GRADUATING MACHINES

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

GRINDERS, Carbide Tool

See Grinding Mches, Carbide Tool

GRINDERS, Centerless

Van Norman Co., Springfield, Mass.

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Conn.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

GRINDERS, Portable Electric and Toolpost

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Millers Falls Co., Greenfield, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

GRINDING FIXTURES

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Besley-Welles Corp., Beloit, Wis.
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Walker-Turner Div. Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

GRINDING MACHINES, Broach

Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

(*Continued on page 332*)



The largest integrated steel mill to be built at one time uses LEHMANN Lathes in its modern maintenance shops!

The Fairless Works, built on 3,900 acres and one of the biggest expansion projects built in our time, incorporates the most modern steel mill equipment available. One of the big jobs at Fairless is that of maintenance. Special shops to keep all the equipment used in this 2.2 million ton plant in top running order are an important part of Fairless.

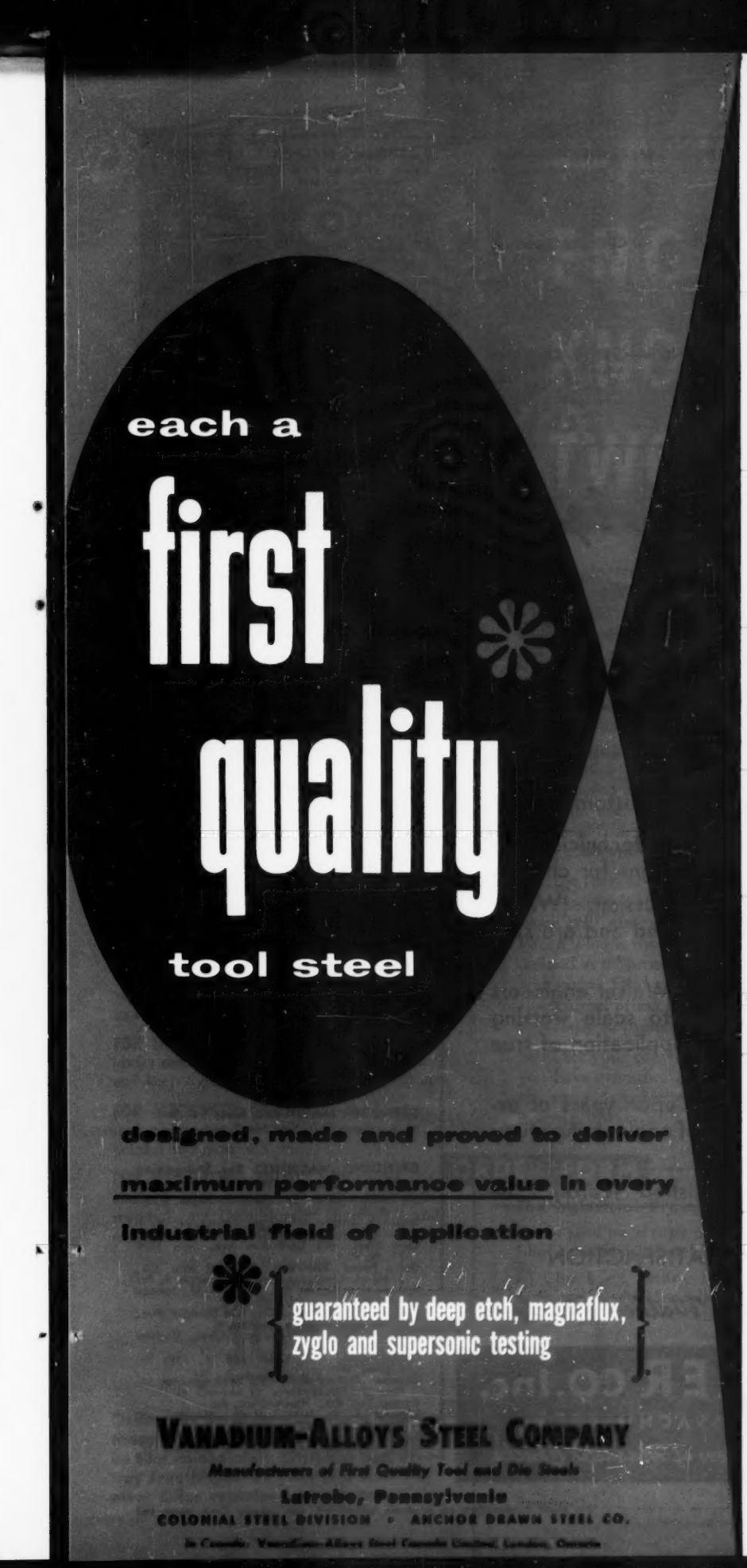
The machine tools, cranes and other equipment necessary for cleaning, machining and repairing the mill operating equipment (which, in fact, make practically all repairs required at Fairless) include 13 Lehmann engine lathes! Some of these lathes are shown in the above photo.

Find out how Lehmann Lathes can bring efficiency, safety and speed to the operations in your plant. Write today for information or catalog — or — send prints for time and money saving recommendation.

LEHMANN
MACHINE COMPANY
GRAND at CHOUTEAU • ST. LOUIS 3, MO.

DIVISION OF NOVO ENGINE CO.

For more information on products advertised, use Inquiry Card, page 241



High Speed Steels

Red Cut Superior†	Van-Lom‡
E. V. M.	8-N-2‡
Red Cut Cobalt	Neatro†
Red Cut Cobalt B	Vasco Supreme‡
Gray Cut Cobalt	Van Cut
Vasco M-2†	

Die Steels for Hot Work

Hotform	SC Special
Choice	WW Hotwork
Marvel	Red Cut Superior ("J" Temper)
Hotpress	
Forge-Die	

Die Steels for Cold Work

Non-Shrinkable	Ohio Die†
Colonial No. 6	Red Star Tungsten
Air Hard	Colonial No. 4
Crocar†	

Carbon and Carbon-Vanadium Tool Steels

Colonial No.14	Elvandi
Colonial No. 7	Red Star Tool
Extra L	Red Star Vanadium

Chrome Vanadium Tool Steels

Vanadium Types D-G-H-K-N	Vanadium Type BB

Tool Steels for Special Purposes

Colhed	CM
Par-Exc	Croman
Silman	Nikro M
Mosil	Speed-Cut

Drill Rod

Red Anchor	Carbon-Vanadium
Blue Anchor	Red Star Tungsten
Gold Anchor	Special Analyses
Oil Hardening	

Cold Drawn Shapes

Special Steels

Our Tool Steels are produced in every form, including hammer-finished bars and blocks, disc and ring forgings, standard and special hot rolled shapes and cold drawn shapes, plates, sheets, rings punched from plate, and tool bits.

‡These grades also available in Free Machining (FM) Type.

GRINDING MACHINES, Carbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GRINDING MACHINES, Centerless

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Chucking

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDER MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Machine Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besley-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Mattison Machine Works, Rockford, Ill.

GRINDING MACHINES, Drill

Blake, Edward Co., 442 Cherry St., West Newton 65, Mass.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gailmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Face

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besley-Welles Corp., Beloit, Wis.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

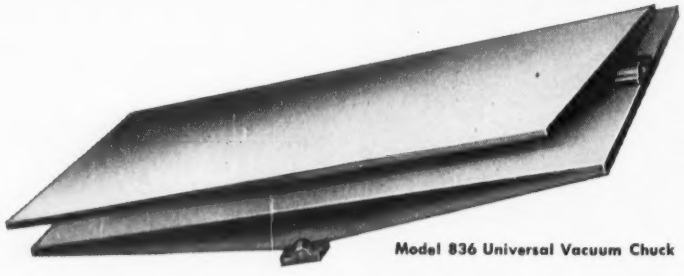
See Gear Grinding Machines

GRINDING MACHINES For Sharpening Cutters, Reamers, Hobs, Etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gailmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

(Continued on page 334)

Walker Does It Again-



Model 836 Universal Vacuum Chuck

The evolution of a satisfied Walker customer:

1. Problem submitted to Walker technicians (75 years' leadership in special designs for chucks).
2. Theoretical research and discussion. (Walker engineers are scientifically trained and are specialists).
3. Practical working models. (Walker engineers and shop men make actual to scale working models). Here is where the application of true scientific principles is utilized.
4. Customer proposal based upon years of experience and a combination of engineering study and practicability.
5. Conclusion: Another Satisfied Walker Customer.

ACTION—RESULTS—SATISFACTION

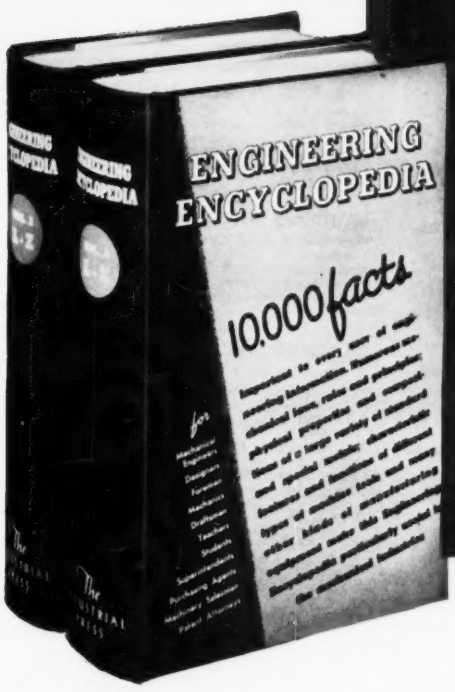
Hold Everything with Walker Chucks

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

For more information on products advertised, use Inquiry Card, page 241



—A WORLD OF ENGINEERING KNOWLEDGE IN TWO VOLUMES!

FOR MECHANICAL ENGINEERS— The Engineering Encyclopedia gives you the facts, figures and miscellaneous information which you need and use every day.

FOR PLANT SUPERINTENDENTS — Contains thousands of essential facts about equipment, materials, processes, standards, etc.

FOR FOREMEN AND MECHANICS— The Engineering Encyclopedia gives you more information with less reading than any other book.

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(*Continued on page 336*)

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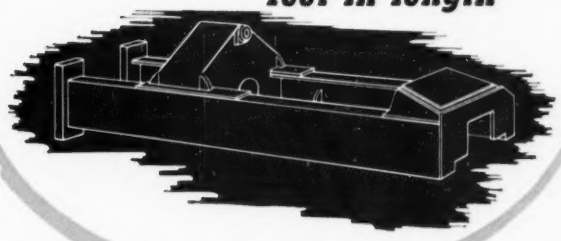
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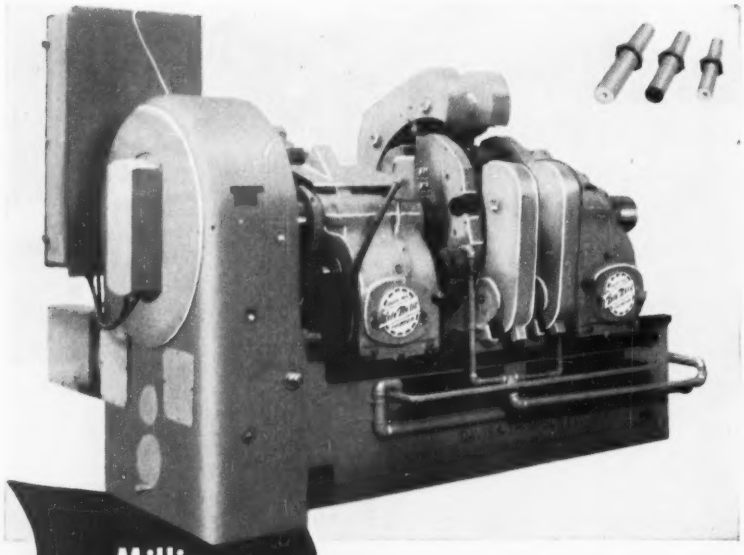
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(Continued on page 340)



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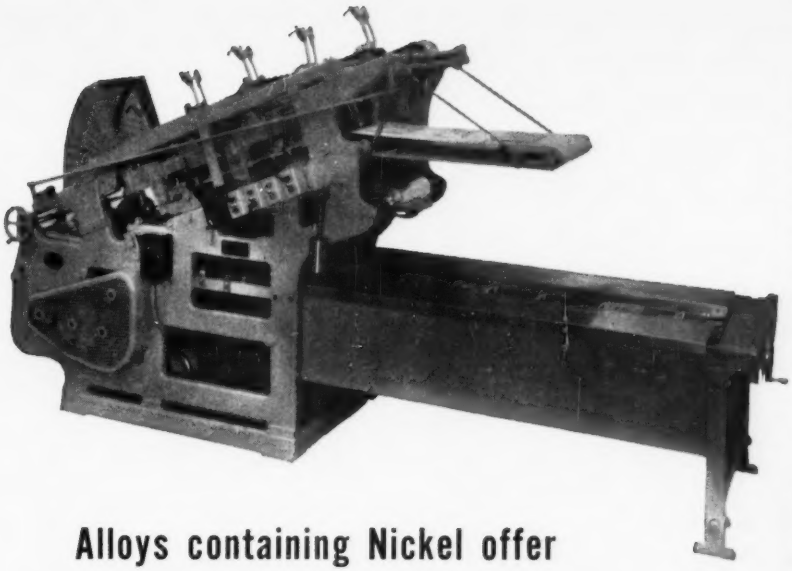
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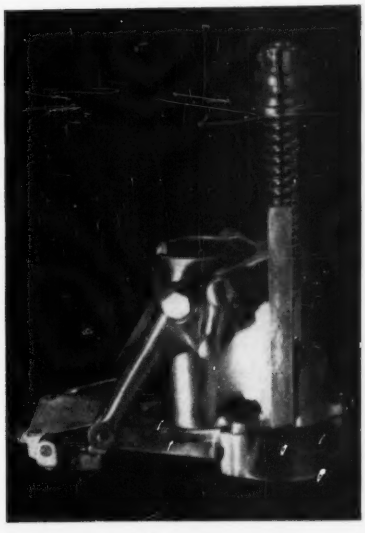
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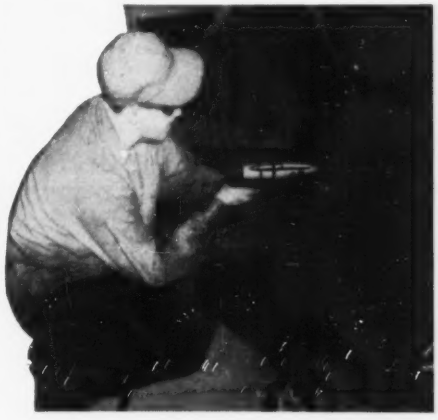


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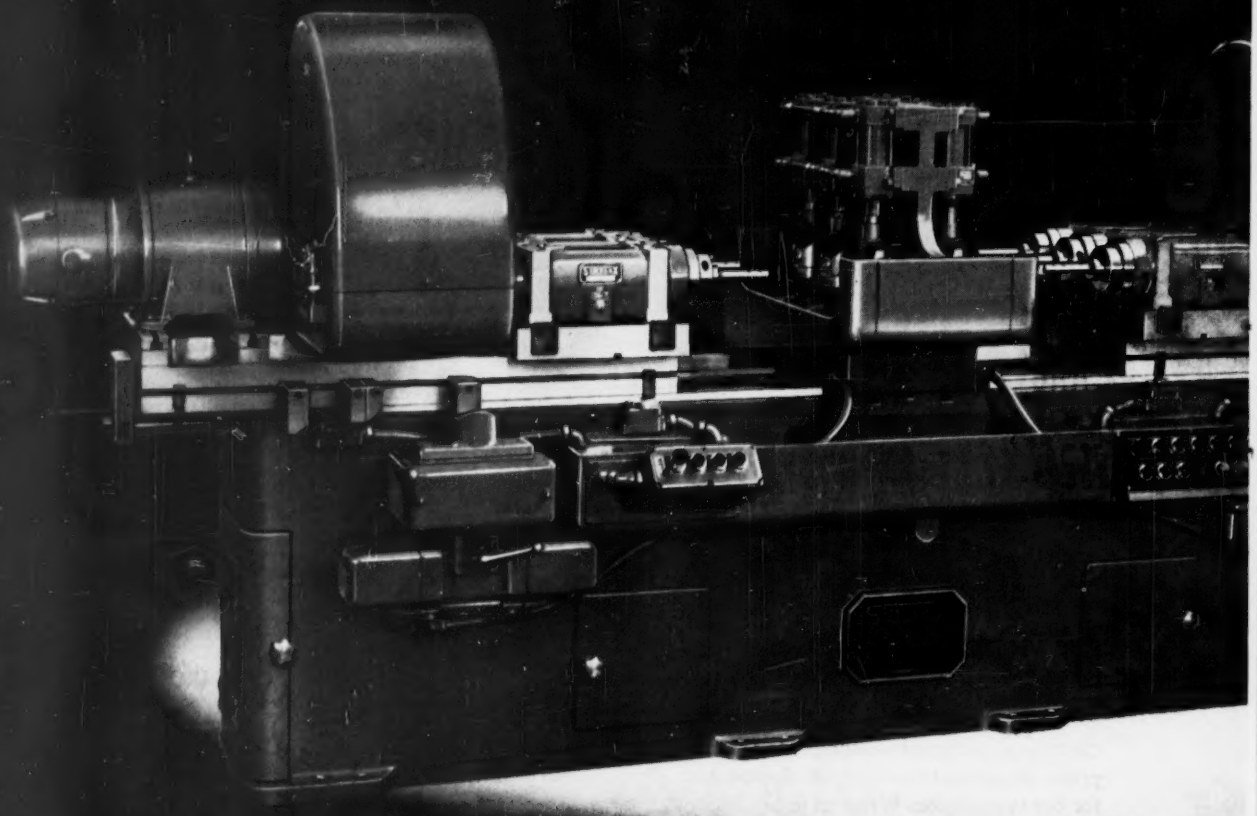


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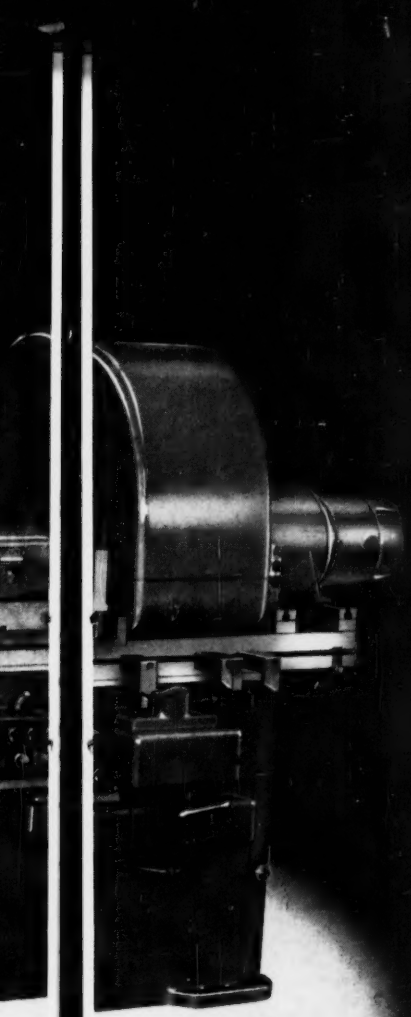
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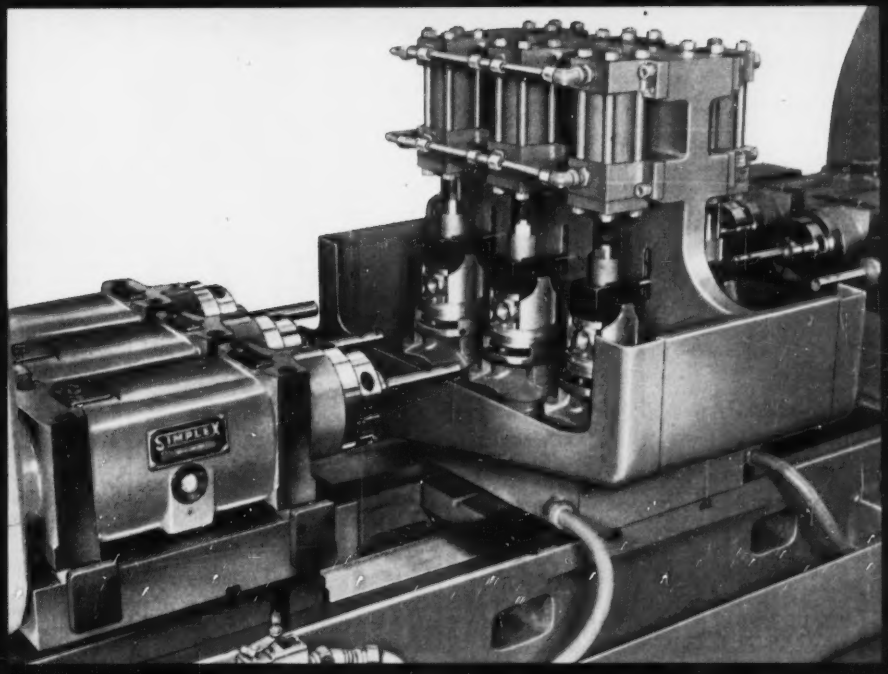
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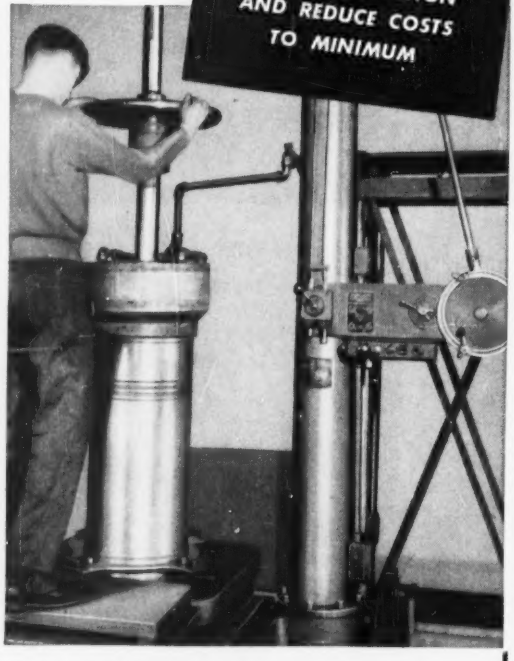
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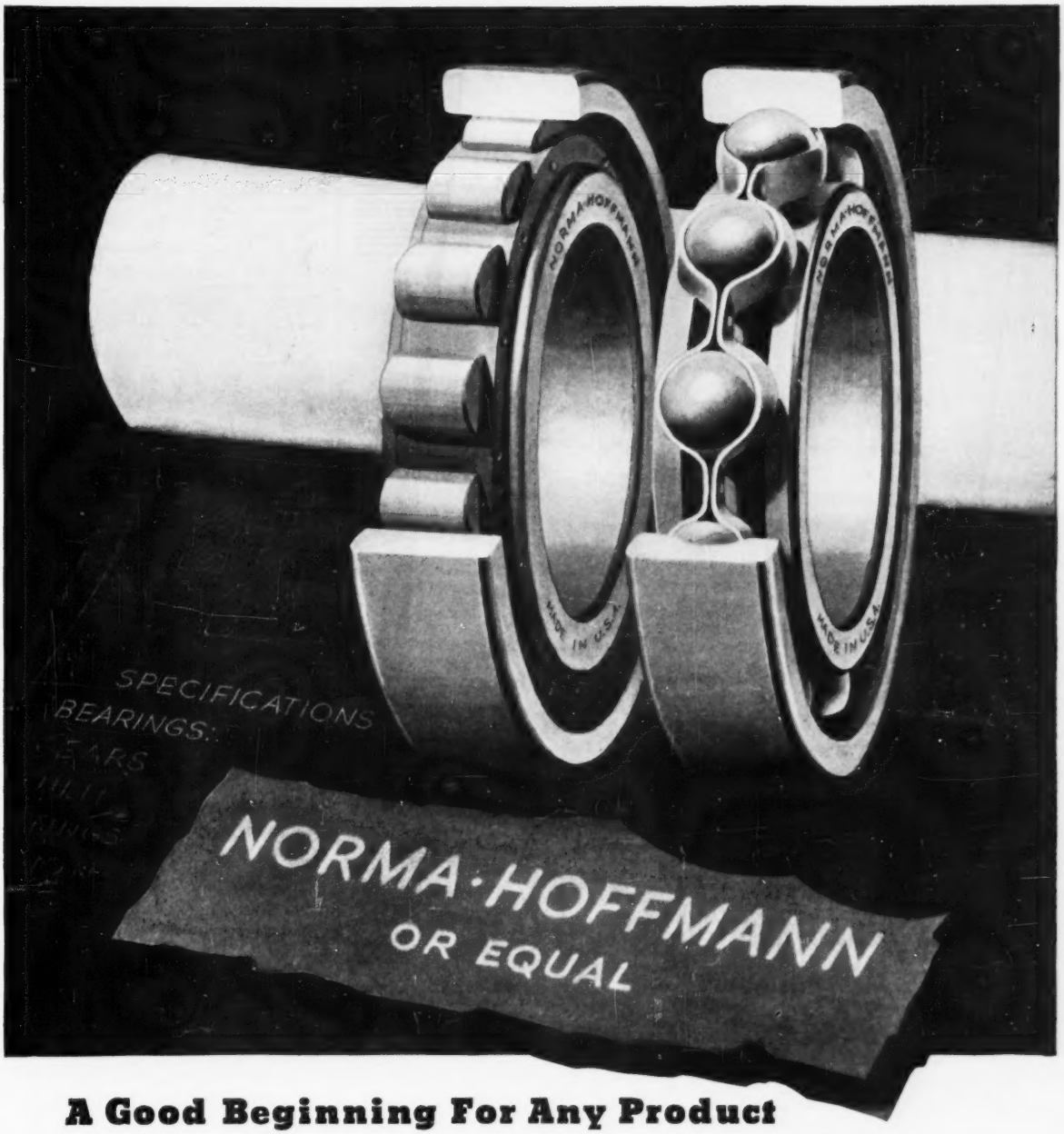
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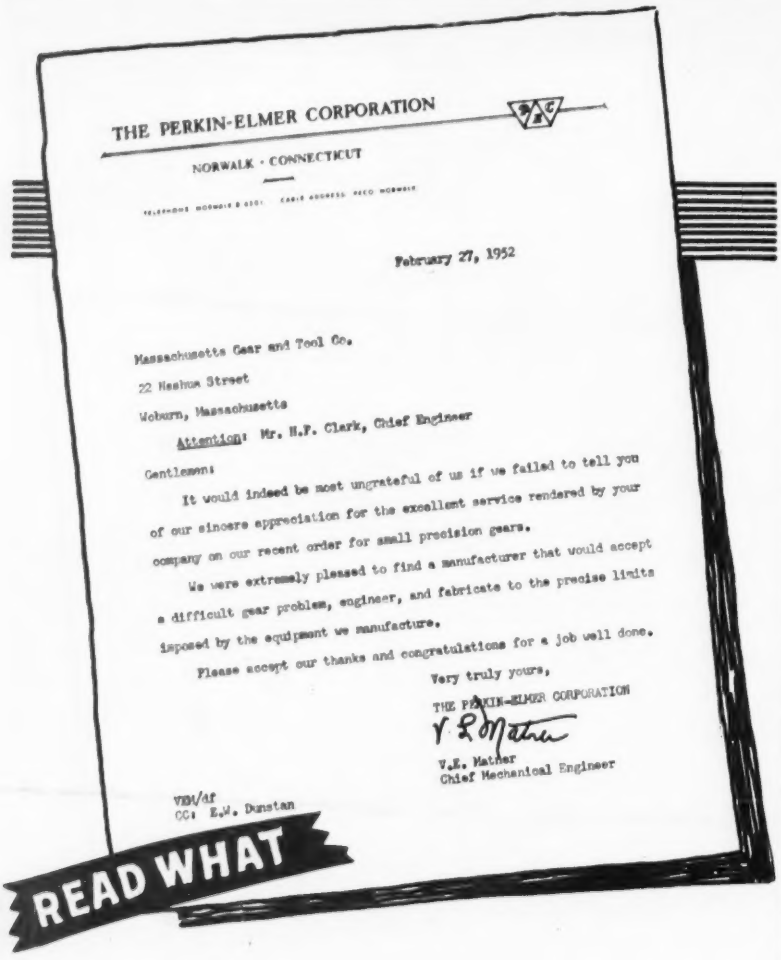
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Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

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Barnes, John S., Corp., Rockford, Ill.
Barnes W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc. 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
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(*Continued on page* 344)

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Meeting unusual bearing requirements in BLAW-KNOX CONCRETE BUCKETS

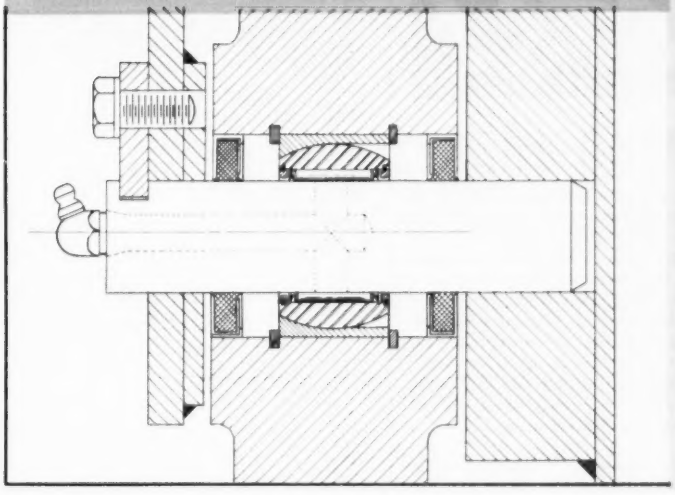
* Gate hinge design required compact, self-aligning bearings suitable for heavy loading at very low speeds



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Rollers can not skew because they are guided by pockets of a free-floating, land-riding cage of anti-friction metal. As a result, these bearings are true running in any position—horizontal, tilted or vertical. They work effectively on overhung mountings—are less affected by misaligned mountings or uneven loading. Reduced internal friction results in smooth, quiet, long-life operation.

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Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

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Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
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Morgan Engrg. Co., Alliance, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

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Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.

JIG BORER

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Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
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Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

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Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.

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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Cincinnati Grinders, Inc. (Centerless), Cincinnati, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6 Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch., 160 Clinton St., Springfield, Vt.
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(Continued on page 346)

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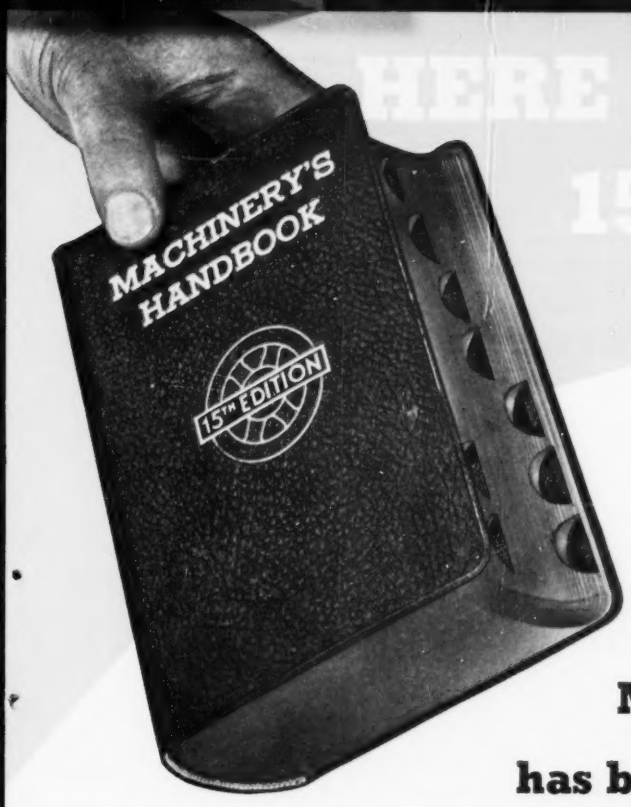
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Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Porter-Cable Machine Co., Salina St., Syracuse, N. Y.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
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Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
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Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Casa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
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Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

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Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
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Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
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Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
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Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
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Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Logan Engrg. Co., 4901 W. Lawrence Ave., Chicago 30, Ill.
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Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
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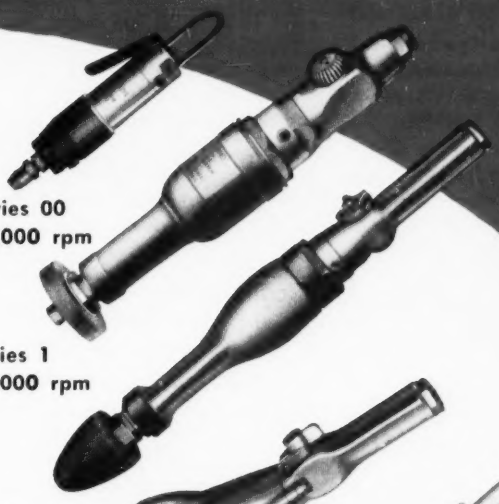
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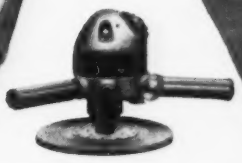


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Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Machine Tool Co., Springfield, Ohio.

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LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Manufacturing Type

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Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

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See Lathes, Engine and Toolroom.

LATHES, Turret

Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Potter & Johnson Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

LAYOUT FLUID

Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

LEVELS

Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LOCKNUTS

Link-Belt Co. (For Positioning Bearings), 519 N. Holmes Ave., Indianapolis 6, Ind.

LUBRICANTS, Including Extreme pressure (EP) Machinery Lubricants

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shear-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS

Farval Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

MACHINE KEYS

Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

MACHINE PARTS, Special

Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MANDRELS

See Arbors and Mandrels.

MARKING MACHINES AND DEVICES

Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.

MEASURING MACHINES AND INSTRUMENTS, Precision

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Crane Parking Co., 1800 Cuyler Ave., Chicago.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR

Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

METAL, Bearings

See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.

METERS

See Recording instruments.

MICROMETERS

Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

(Continued on page 350)

For more information on products advertised, use Inquiry Card, page 241

REDUCE YOUR COST OF RADIAL HOLE-DRILLING!

A Standard Machine Designed for Variety Production



Why build a special machine for drilling radial holes when a standard machine equipped with Govro-Nelson Automatic Drilling Units will, in many cases, perform the work of a special machine that would cost considerably more!

Any number of drilling units up to eight may be employed, the units being movable not only through 360 degrees on the circular table but also movable endwise on riser plates to meet the requirements of the part being drilled.

The machine may also be used for tapping operations with Govro-Nelson Tapping Units. It has a range of 1/32″ to 3/8″ on drilling operations and 0-80 to 3/8-16 on tapping operations, depending on material and spindle speeds. A single, momentary contact start-button causes all units to operate simultaneously.

If you are interested in reducing the cost of your radial drilling and tapping operations, write for price and dimensional data.

WRITE FOR *Literature*

Automatic DRILLING UNIT

GOVRO-NELSON CO.
Machinists of Precision Parts for 30 Years
1933 ANTOINETTE DETROIT 8, MICH.

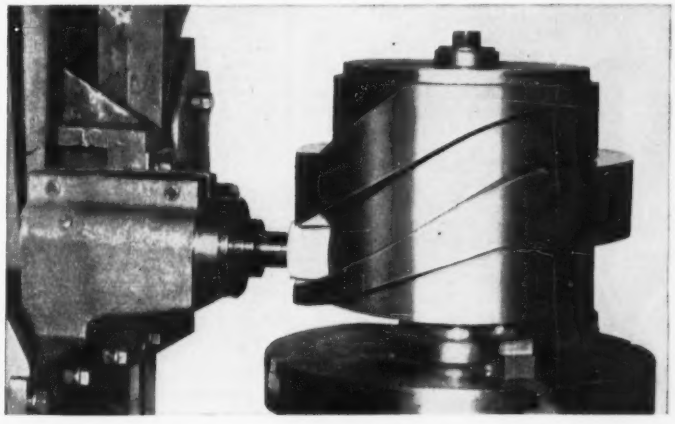
ROWBOTTOM now offers CAMS GROUND after HARDENING

. . . a NEW SERVICE which provides:

- . . . longer cam life
- . . . maintained accuracy in operation
- . . . less down time for repairs or maintenance
- . . . greater load capacity
- . . . more freedom in design to meet specific functions of cams
- . . . greater economy in the overall performance of the equipment in which the cams are used

Also:

CAM MILLERS and GRINDERS



Grinding an indexing cam on a Rowbottom Milling Machine.

Rowbottom is a specialist not only in cam production on contract but is also the pioneer designer and builder of machines for producing cams: CAM MILLERS and CAM GRINDERS . . . for accurate, low cost production of all types of cams such as barrel, face and box.

Outline your requirements and ask Rowbottom for recommendations. Send drawings or specifications for estimate. Illustrated literature available promptly on request.

Rowbottom CAMS

THE ROWBOTTOM MACHINE COMPANY
WATERBURY CONNECTICUT, U.S.A.

For more information on these products, use Inquiry Card, page 241

GET ABSOLUTE
Tolerance Hole Depth Control WITH
WOHLNIP



Non-Rotating DRILL STOPS

Will not mar, mark or damage the face of the work, fixture or bushing, yet give POSITIVE CONTROL OF HOLE DEPTH. Completely automatic, the WOHLNIP Drill Stop reduces human errors, simplifies difficult jobs, lowers machining cost, increases production, and eliminates rejects. Used for drilling, center drilling, countersinking, boring, milling, routing, reaming. Available with straight or taper shank, for any size drill or tool. (Patent Pending)



DRILL EXTRACTORS





Reduce down time, salvage valuable parts with the WOHLNIP Drill Extractor. Built for many years of dependable service, the WOHLNIP Drill Extractor is furnished complete to handle all standard broken drills from 1/8" to 1/2"—a total of 160 drills. A broken drill, "frozen" tight in the hole, is easily removed in a few minutes, even by inexperienced operators. Set-up does not have to be removed. No special machines or tools needed; everything is in the handy kit shown. (Patent Pending)



Revolving STOCK STOPS

3 Interchangeable Noses

HAS WHAT IT TAKES

Get positive length control; eliminate whipping or marring of stock ends; get greater production uniformity. Will stand up under hard use because it is made of highest quality materials, hardened and ground. It is highly impact resistant. Available with interchangeable V-Centering, Flat, or Ball Point nose pieces.

EXCLUSIVE DISTRIBUTORS WANTED

WOHLNIP
PRODUCTS, INC
390 Hillside Avenue
Hillside, New Jersey

Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MICROSCOPES, Toolmakers

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING ATTACHMENTS

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati.
Consolidated Machine Tool Corp., Rochester, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING AND CENTERING MACHINES

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Barker Engrg. Co., 500 Green Rd., Cleveland 21, Ohio.
Hardinge Bros., Inc. (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Circular Continuous

Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Barker Engrg. Co., 500 Green Rd., Cleveland 21, Ohio.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain and Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Marac Machinery Corp., 45 So. Broadway, Yonkers, N. Y.
Orban Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway. Albany, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney West Hartford 1, Conn.

MILLING MACHINES, Profile

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Turret Type

Bridgeport Machines, Inc., Linley Ave., Bridgeport, Conn.

(*Continued on page 354*)

For more information on products advertised, use Inquiry Card, page 241

Makes soft jobs out of tough nuts

AFTER hundreds of flight hours, the propeller retaining nut that holds an airplane propeller on its shaft often "freezes". Loosening it used to be an hours-long job. Hand wrenches were ruined in the process. Sometimes the nut had to be cut off.

Then someone thought up a hydraulic propeller retaining nut torque wrench. It enabled one man to apply as much as 5,000 pounds feet of torque on the nut—10 times the force he could exert with a 3-foot bar.

But the problem was to develop a wrench socket that would stand up under this pressure. In service, the socket was apt to break or twist out of shape. During the necessary heat treating, it often became distorted and had to be scrapped.

Kell-Strom Tool Company, Inc., of Weathersfield, Connecticut, manufacturers of aircraft propeller tools, took the problem to metallurgists of the Timken Company. After careful study it was recommended that the socket be made from 52100—a Timken® fine alloy steel.

Kell-Strom tried it, found that sockets made from Timken 52100 steel tubing greatly increased the life of the tool. There was less breakage or twisting out of shape. Because 52100 could be heat treated before machining, distortion and scrap were reduced to a minimum. In addition, the splines of the socket were easier to machine than with the steel previously used.

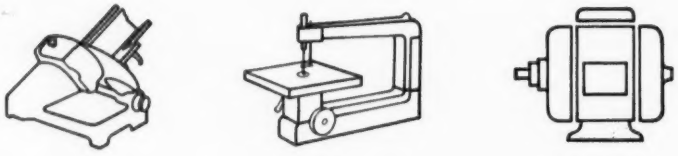
This is only one of the many tough problems stamped "Solved—by Timken Alloy Steel". If you have any tough nuts that need cracking, why not let us help you. Write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO". Tapered Roller Bearings, Alloy Steel and Seamless Tubing, Removable Rock Bits.





Here's more that Lowe Brothers THERMO SPRAFIL® system is the "hottest" news in industrial finishes today!

As a manufacturer of both hot and cold lacquer systems, Lowe Brothers have found that the hot lacquer system is rapidly becoming the *preferred system* in an increasing number of manufacturing plants. The reasons?—Faster handling and lower cost of all finishing operations. Here's a typical case history.

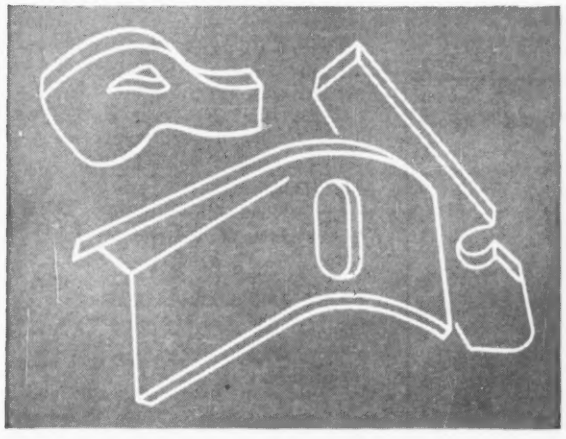


NOTE: This advertisement is based on facts from Lowe Brothers case history files.

"case history" proof

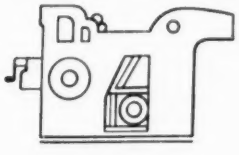
CASE HISTORY: *Thermo Sprafil System* eliminates 3 baking operations—speeds up production!

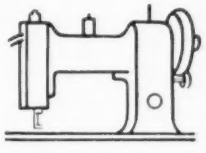
Wanting to speed the flow of heavy castings through his finishing operation, a large eastern manufacturer installed the *Thermo Sprafil* "hot" system at the suggestion of a Lowe Brothers "Finishing Specialist." Here's what happened: 1. Due to *Thermo Sprafil's* fast drying advantages, *three* separate baking operations were eliminated on every casting! 2. Sanding was eliminated! 3. All handling time and labor required to put castings through the *three* bakings were eliminated. 4. The three ovens were removed, releasing many square feet of vital factory floor space for other use. 5. Actual time required for complete finishing operation on each casting was cut from 12 to 4 hours

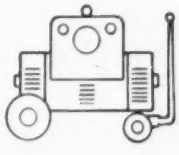


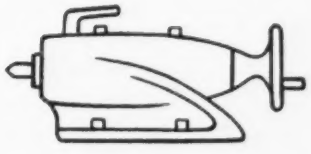
More and more manufacturers are seeing proof that Lowe Brothers *Thermo Sprafil System* provides the finest in finishing results while *eliminating* many of the costly and time consuming features of old cold lacquer systems. Get full details about the *modern Thermo Sprafil System*. Let a Lowe Brothers "Finishing Specialist" give you his recommendations based upon complete knowledge of the most up-to-the-minute finishing developments. No obligation. Why not write for more information today?

THE LOWE BROTHERS COMPANY • Dayton 2, Ohio
Industrial Division
District Offices:
Atlanta, Boston, Chicago, Jersey City, Kansas City









***Thermo Sprafil* is saving money and speeding production for manufacturers of a wide range of products. How about yours?**

LEADERSHIP THROUGH CONSISTENT SERVICE

Lowe Brothers
FINISHES FOR INDUSTRY
since 1870

MILLING MACHINES, Vertical
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Marac Machinery Corp., 45 So. Broadway, Yonkers, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. C., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Burke Machine Tool Div., Cincinnati 27, Ohio.

MODEL AND EXPERIMENTAL WORK
See Special Machinery and Tools.

MOLD AND DIE COPYING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MOLDING MACHINES, Plastic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

MOTORS, Electric
Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Howell Electric Motor Co., Howell, Mich.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

MOTORS, Hydraulic
Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NIBBLING MACHINES
Campbell Machine Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn.

NIBBLING MACHINES, Nickel
International Nickel Co., Inc., 67 Wall St., New York, N. Y.

NIPPLE THREADING MACHINERY
Landis Machine Co., Inc., Waynesboro, Pa.

NUT MAKING MACHINERY
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

NUT SETTING EQUIPMENT
See Screw Driving and Nut Setting Equipment.

NUT TAPPERS
See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap
Chicago Screw Co., Bellwood, Ill.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Republic Steel Corp. (Union Drawn Steel Div.), Republic Bldg., Cleveland 1, Ohio.
Union Drawn Steel Co., Div., Republic Steel Corp., Massillon, Ohio.

NUTS, Self-locking
Grip Nut Co., 310 S. Michigan Ave., Chicago 4, Ill.

NUTS, Thumb or Wing and Cap
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only).
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Republic Steel Corp., Bolt and Nut Div., Republic Bldg., Cleveland 1, Ohio.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

OIL CUPS
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

OIL EXTRACTORS AND CLEANERS
De Laval Separator Co., Poughkeepsie, N. Y.

OIL GROOVERS
Fischer Machine Co., 310 No. 11th St., Philadelphia, Pa.
Wicaco Machine Co., Stenton Ave. and Louden St., Philadelphia, Pa.

OIL-HOLE COVERS
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

OIL SEALS
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.

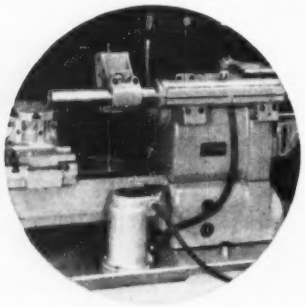
OILS, Cutting
See Cutting and Grinding Fluids.

OILS, Lubricating
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.

(*Continued on page 358*)

RUTHMAN GUSHER COOLANT PUMPS



SOLVE YOUR COOLANT PROBLEMS

This Hardinge Model HCT Chucking Machine with Production Threading Head is equipped with a Gusher Coolant Pump.



For all your coolant pump requirements, there's a type and capacity Gusher Coolant Pump to meet your every need.

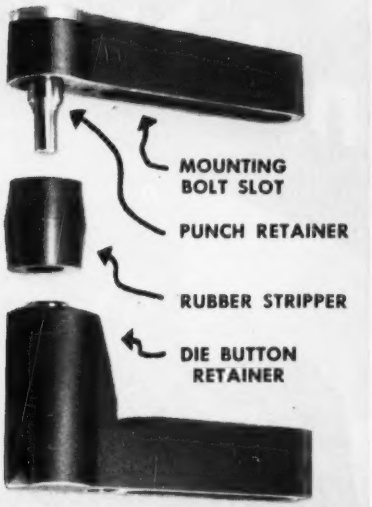
You can choose between immersed type, outside mounted pipe connected, flange mounted with external or internal discharge in capacities up to 200 G.P.M.—1/30 to 2 H.P. Shaft and belt driven models also available. Write for our complete catalog.

THE RUTHMAN MACHINERY CO.
1807 READING ROAD — CINCINNATI, OHIO

For more information on products advertised, use Inquiry Card, page 241

New

PUNCH & DIE BUTTON POSITIONING *Flexibility* with R-B *Flex-Mount* RETAINERS

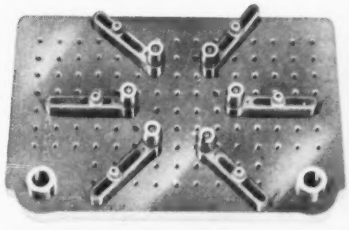


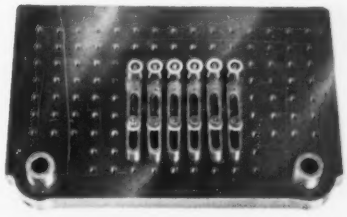
Cut your set-up time for short production runs on light gauge metals . . . R-B Flex-Mount Retainers permit quick, easy and flexible mounting of punches and die buttons. For, Flex-Mount Retainers are easily bolted in any desired position on T slotted or drilled and tapped commercial die sets.

Standardized R-B punches and die buttons (round, square, oblong or special shapes to customer specifications) are used in these retainers. Stripping is accomplished with R-B rubber strippers or R-B rubber covered springs to eliminate costly metal strippers, retainer screws and springs.

TYPICAL *Flex-Mount* POSITIONING *Flexibility*

Shown are but two of an almost unlimited number of mounting arrangements that can be made with Flex-Mount Retainers.





Use R-B Engineering Service for Your Tough Piercing Problems

RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
DEPT. 78 • 12619 BURT RD. • DETROIT 23, MICHIGAN

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COMPANY _____

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Also Produced in
OTHER ALLIED PLANTS
SPECIAL COLD FORGED PARTS,
STANDARD CAP SCREWS
PRECISION GROUND PARTS
SHEET METAL DIES
MADE OF FERROUS ALLOYS,
ZINC ALLOYS OR PLASTICS

For more information on products advertised, use Inquiry Card, page 241


T-P SUPERPOWER MAGNETIC CHUCKS
SIMPLIFY and SPEED
T-P MACHINE TOOLS
T-P CompAIRator



with these STANDARD TAFT-PEIRCE PRODUCTS

Chances are you're already using many items from some of these Taft-Peirce product lines. You should know them all. Each has certain exclusive advantages that set it apart from competitive products. Many of them are actually not competitive at all — since in their own specific field of application, nothing else compares. For example:

T-P Superpower Electro-Magnetic Chucks pack more power in less space. New T-P Permanent Magnet Chucks are longer, stronger, 20% lower — give greater clearance on machine tool tables.

T-P #1 Surface Grinders and Lapping Machines make it easy to produce surfaces to an accuracy, flatness, and finish previously considered difficult or impossible.

T-P CompAIRators measure a wider range and variety of work than any other air gage. The COMPUTING CompAIRator also solves simple problems... simplifies many complex measurements.

T-P Rotochek, a valuable part of the T-P line of fixed gages, is the fastest thread gaging method yet devised. Just push — and the gage enters the work. Pull — and it disengages automatically.

T-P Tool Room Equipment includes many special time-and-labor-saving devices such as Multiplex Angle Irons, the extra wear-resistant T-P Granite Surface Plates, and Precision Levels to mention only a few.

Each of these products is part of a complete Taft-Peirce line. Available in standard or special models tailored to your needs. Full details are described in the new Taft-Peirce Handbook. Write for your copy today.

T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY • WOONSOCKET, RHODE ISLAND

OILS, Soluble

See Compounds, Cutting, Grinding, Metal Drawing, Etc.

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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

ORDNANCE MACHINES, Special

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

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Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Waston-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

PAINTING EQUIPMENT, Spray

Lowe Bros. Co., Dayton, Ohio.

PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal

Mummert-Dixon Co., Hanover, Pa.

PILLOW BLOCKS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

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American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Revere Copper & Brass Inc. 230 Park Ave., New York, N. Y.

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Alleghany Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

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Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.



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COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILL.

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Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLATE ROLLS

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

PLATES, Surface

Brown & Sharpe Mfg. Co. Providence, R. I.
Challenge Machinery Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Div., West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

PNEUMATIC EQUIPMENT

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.
Onsrud Machine Works Inc., 3940 Palmer St., Chicago, Ill.

POLISHING LATHES AND MACHINES

Black & Decker Mfg. Co., Penna. Ave., Towson, Md.
Gardner Machine Co., (Div. Landis Tool Co.), 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POLISHING TOOLS, Portable

Jarvis, Charles L., Co., Middletown, Conn.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads

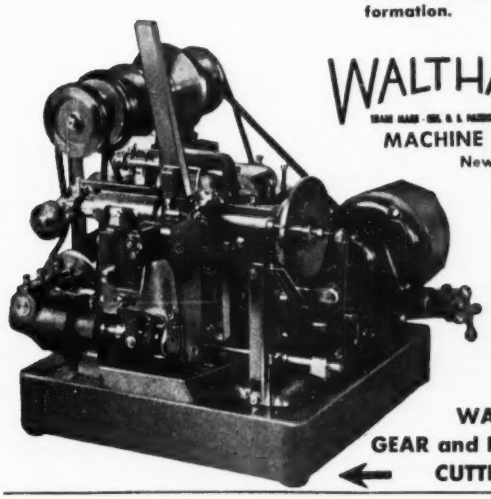
(*Continued on page 360*)

For more information on products advertised, use Inquiry Card, page 241

SMALL GEAR AND PINION PRODUCTION THAT'S

Automatic!

Automatic loading and unloading feature eliminates lost motion in producing accurate small diameter, fine pitch gears and pinions on the Waltham. Individual motor drive through step cone pulleys gives a wide range of feeds and speeds. Compact design takes up less than 4 sq. ft. on the bench. If you want accurate . . . fast . . . economical small gear production get full information.



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MACHINE WORKS
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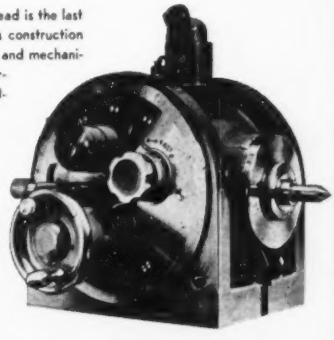
THE WALTHAM GEAR and PINION CUTTER

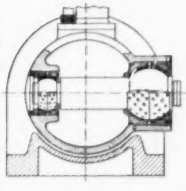


A CUSTOMER SPEAKS:

"Without our Optical Dividing Head, we would not even attempt to make the critical indexing work nowadays necessary for things that fly, or mechanism that must control angular motions to hit targets at a distance, to measure degrees, minutes and seconds, to eliminate angular velocity errors and vibrations in quick running mechanisms, etc."

The LEITZ Optical Dividing Head is the last word in indexing precision. Its construction is different from other optical and mechanical dividing heads on the market. A NEW DOUBLE SPHERICAL BALL BEARING, DOUBLE READING IN THE SAME EYEPIECE 180° APART, motor drive attachment and other features make the LEITZ an important aid required in any shop where precision is demanded.



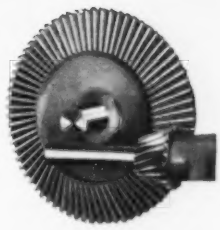


The 2 spherical ends of the spindle are carried in hardened steel cups with several hundred small precision balls held in place by ball cages in such a way that each ball creates its own path. There is no play, either radially or axially, no oil film, no wear and a very large load capacity.

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Whatever your needs may be in the line of gears—if you want quality gears economically produced, BILGRAM IS THE ANSWER! Any material, any quantity, any type—Bevel Gears with straight or spiral cut teeth—Ellipticals—Herringbones—Helicals—Racks—Spurs—Hypoids—Worms. Over 60 years' experience, specially designed equipment and fully modern plant assure satisfaction. Estimates gladly furnished.

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Manufacturers of Bevel Gear Generators and Chamfering Machines

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PRESSES, Air

Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.

PRESSES, Arbor

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Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Farquhar, A. B., Div Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Extrusion

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Foot

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morgan Engrg. Co., Alliance, Ohio.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

PRESSES, Pneumatic

Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.

PRESSES, Screw

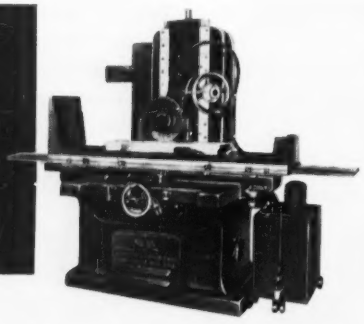
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working

Allen, Alva F., Box 426, Clinton, Mo. (Bench)
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Farquhar, A. B., Div., Oliver Corp., 142 North Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.

(*Continued on page 362*)

When the need is for SPEED and PRECISION



you need a

GRAND RAPIDS GRINDER

Here is extra value, extra accuracy, extra high-speed performance. Every Grand Rapids Hydraulic Feed Surface Grinder has a one-piece column and base for vibrationless rigidity and permanent alignment between cross travel ways and upright headways. Both longitudinal table travel and cross feed are hydraulically operated. On the larger machines, the wheel head is powered for rapid vertical travel. ***The model 55 has longitudinal table speed of 125 fpm.!***

Parts machined to micrometric tolerances, precision assembled for freedom of action, no play. That's why 6 out of 10 are sold to firms already using Grand Rapids Grinders.

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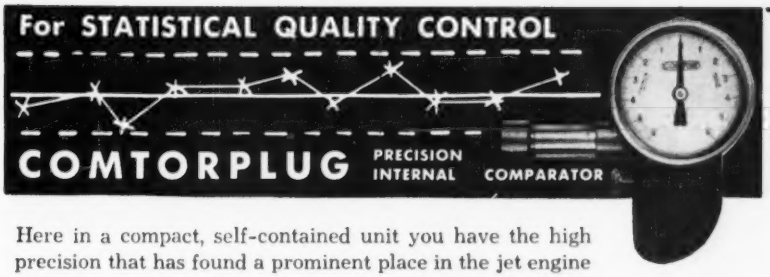
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For more information on products advertised, use Inquiry Card, page 241



Here in a compact, self-contained unit you have the high precision that has found a prominent place in the jet engine program, the automatic transmission program and other fast moving set-ups. Used at machine or bench, Comtorplug has self-aligning features assuring accuracy. Ideal for Statistical Quality Control programs. Comtor Co., 74 Farwell St., Waltham 54, Mass.

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With Interchangeable Expansion Plugs from ⅛" to 8" dia.



For gaging high-precision holes to fractions of .0001"

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"Packaged Precision"

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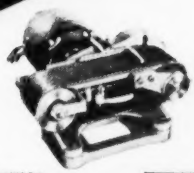
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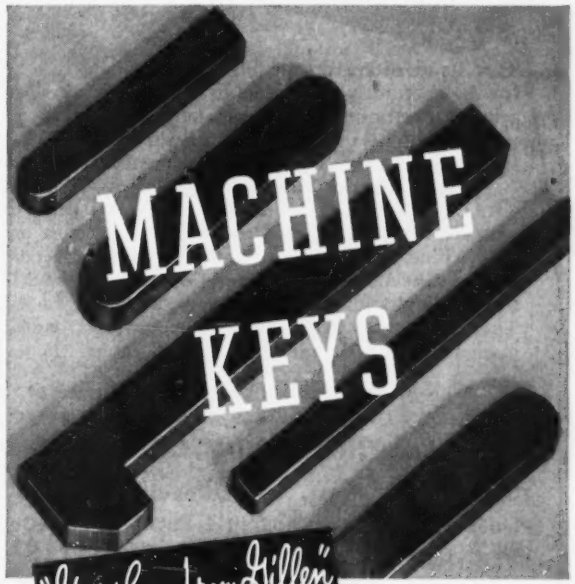
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ABRASIVE BAND GRINDER



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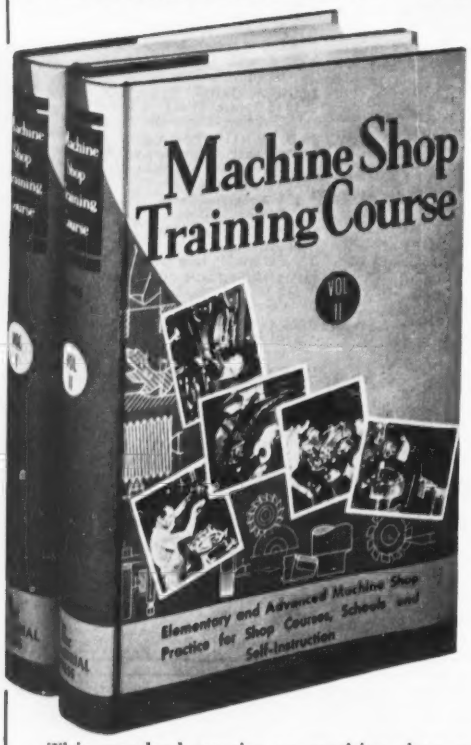
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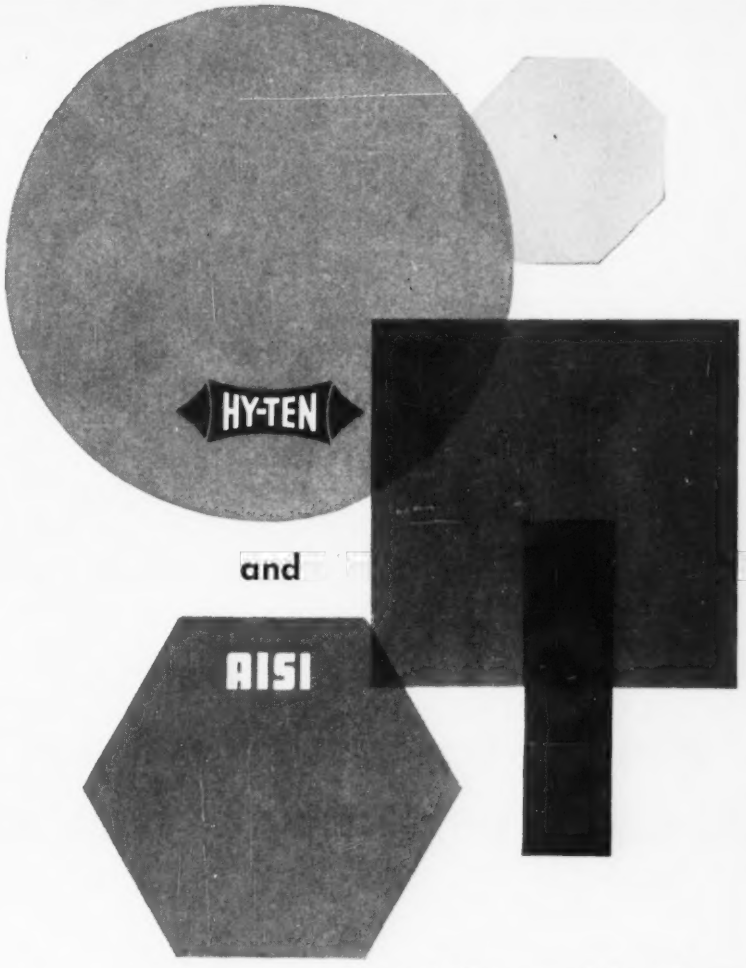
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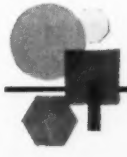
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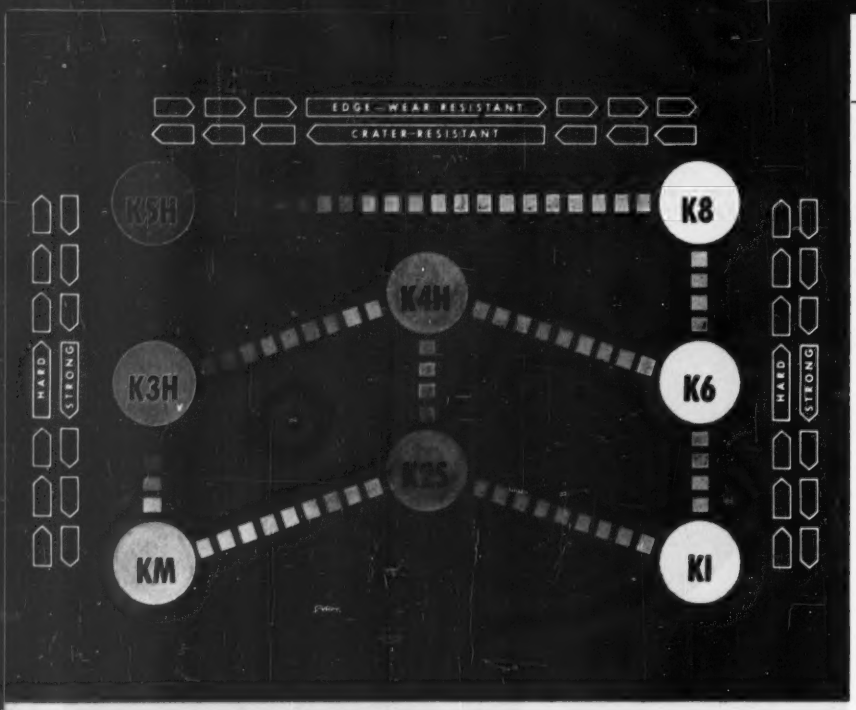
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Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Machine Corp., Stenton Ave., and Louden St., Philadelphia, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle

Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINES, Hand

See also Lathes, Turret

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Winter Bros. Co., Rochester, Mich.

SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Chicago Screw Co., Bellwood, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-tapping, Drive

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

SCREWS, Thumb

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Parker-Kalon Div., General American Transportation Corp., 200 Varrick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SEALS AND RETAINERS, Oil or Grease

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

SECOND-HAND MACHINERY, Etc.

Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Miles Machinery Co., Box 770, Saginaw, Mich.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

SEPARATORS, Centrifugal

De Laval Separator Co., Poughkeepsie, N. Y.
The Sharples Corp., 2300 Westmoreland St., Philadelphia 40, Pa.

SEPARATORS, Oil or Coolant

Barnes Drill Co. (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
The Sharples Corp., 2300 Westmoreland St., Philadelphia 40, Pa.

SHAFTING, Steel

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAFTS

National Forge & Ordnance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAFTS, Flexible

Jarvis, Chas. L., Co., Middletown, Conn.

SHAFTS, Hollow-Bored

Bethlehem Steel Co. Bethlehem, Pa.

SHAFTS, Turned and Ground

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAPER-PLANERS

Rockford Mch. Tool Co., 2500 Kishwaukee St. Rockford, Ill.

SHAPERS

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Smith & Mills Shapers, Inc., Div. Hamilton-Thomas Corp., Hamilton, O.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

SHAPERS, Vertical

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPES, Cold Drawn Steel

Columbia Steel & Shafting Co., P.O. Box 1557, Pittsburgh 30, Pa.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P.O. Box 1557, Pittsburgh 30, Pa.

SHAPES, Structural

Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

(*Continued on page 368*)

SHEARING MACHINERY

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

SHEARS, Rotary

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.

SHEET METALS

American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
New Jersey Zinc Co., 160 Front St., New York, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHIMS

Laminated Shim Co., Inc., Glenbrook, Conn.

SLEEVES

Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SPECIAL MACHINERY AND TOOLS

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Fischer Machine Co., 310 No. 11th St., Philadelphia, Pa.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Greenlee Bros. & Co., 12th and Columbia Aves., Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2.
Hydraulic Press Mfg. Co., 30, Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
John, B. Manufacturing Co., Ellis St., New Britain, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morgan Engrg. Co., Alliance, Ohio.

(Continued on page 369)



Precision
DUPLICATING
on ANY Engine or Turret
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Lehigh
TRACER-TOOL
PROFILE-TRACING
LATHE ATTACHMENT

No Complicated Hydraulic or Electronic Controls

Fast set-up for short or production runs. Requires no permanent lathe alterations. Accommodates all types of tool holders, square turrets, grinding attachments, clapper boxes, boring bars, etc. For contour turning, facing, grinding, boring, Bullard operations. Unlimited radii, 90° steps, threading to a shoulder, etc. Uses low cost, easily made templates. Models for all lathes 9" to 24" and larger. Thoroughly proven in shops and plants of every size.

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Manufacturers of LEHIGH Air Valves • Air Cylinders • Air Hoists • Air Motors
West Coast Dist.: CAMPBELL CONTOUR ATTACHMENT CO., 1320 W. Esther St., Long Beach, Cal.

For more information on products advertised, use Inquiry Card, page 241

Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch Match & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicoco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

SPEED REDUCERS

Boston Gear Work, 320 Main St., North Quincy 71, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Perkins Machine & Gear Co., West Springfield, Mass.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Pope Mchry. Corp., Haverhill, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

SPINNING LATHES

See Chucking Machines.

SPROCKET CHAINS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

SPROCKETS

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, All Metal

LaSalle Steel Co., Hammond, Ind.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

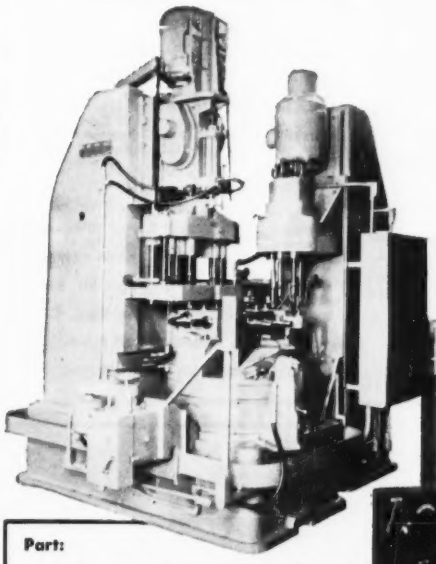
STAMPINGS, Sheet Metal

Laminated Shim Co., Inc., Glenbrook, Conn.
Republic Steel Corp., Niles Steel Products Div., Republic Bldg., Cleveland 1, Ohio.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

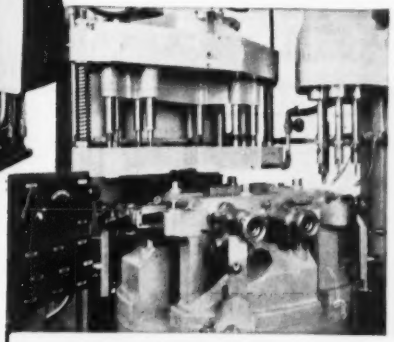
STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co., of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Summerill Tubing Co., Div., Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 Ave., Pittsburgh, Pa.
U. S. Steel Supply Div., U. S. Steel Co., 208 S. LaSalle St., Chicago 4, Ill.
Wheeler-Lovejoy & Co., Inc., Cambridge, Mass.

(Continued on page 370)



MULTIPLY PROFITS BY MULTIPLE OPERATIONS



Part:

Steering gear housing. (Two different parts run on same machine with tool change only.)
Material: Malleable iron.
Operation: *Station 1*—Load and unload. *Station 2*—Drill (3) .368" holes; (1) .120" hole. *Station 3*—Combination spot face and chamfer (3) holes, drill (1) 23/32" hole for tapping. *Station 4*—Tap (3) 7/16"-14 NC-3 thread; tap 1/2"-14 NPSF thread.
Description: Millholland 4-station automatic index machine equipped with 4-station automatic index table, with 1 No. 5 Millholland Automatic Unit driven by 7-1/2 HP motor with 8-spindle ball bearing multiple head for drilling 5 holes and combination spot facing and chamfering 3 holes; 4-spindle tapper on right-hand column.
Operator loads part and pushes button initiating automatic cycle, unloads. Two parts machined at a time.

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For special production machines, Millholland Automatic Units offer distinct advantages. These self-contained units, driven by individual motors, are readily adapted to a wide range of operations. Their full automatic cycle with interlocked controls permits several units to be grouped for simultaneous operations, or they can be mounted on other production machines and synchronized to perform additional operations. Millholland Automatic Units have proved themselves in 30 years of outstanding performance on all types of jobs. Get full details in Bulletin M-8.

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Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., Massillon, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div., Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS
See Alloys, Steel

STEEL BARS
See Bars, Steel

STEEL STOCK GROUND FLAT
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh, Pa.

STELLITE
Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

STOCK STOPS
Wohlnip Engineering Co., 390 Hillside Ave., Hillside, N. J.

STOCKS, Die
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. of Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.

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Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

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Standard Pressed Steel Co., Jenkintown, Pa.

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Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

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Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES
See Plates, Surface

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(Continued on page 372)



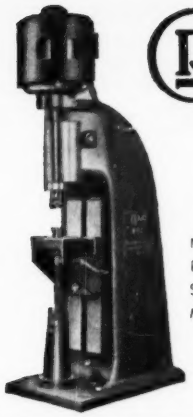
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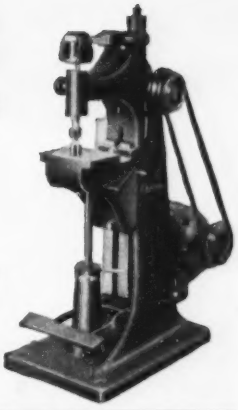


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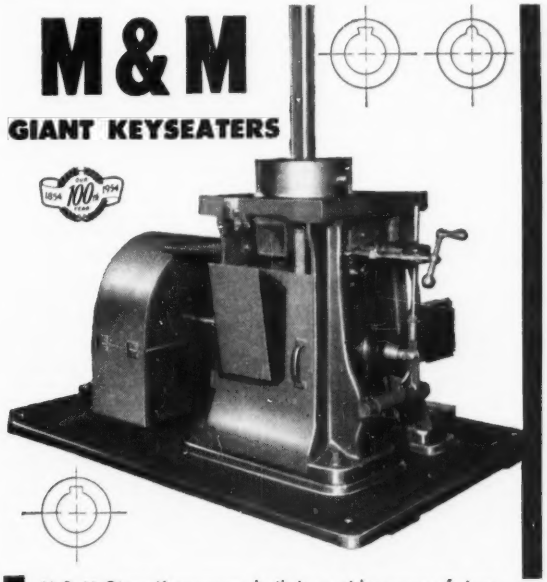
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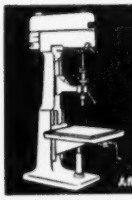


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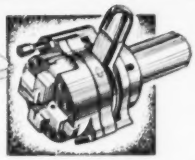
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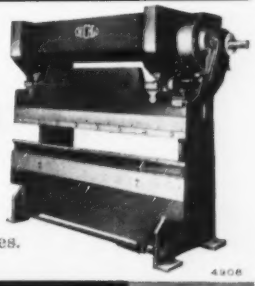
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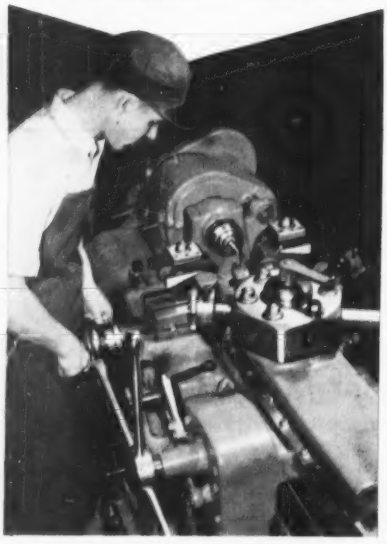
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Chicago Screw Co., Bellwood, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.
Pratt & Whitney, West Hartford 1, Conn.

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DoAll Co., 254 N. Laurel Ave. Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
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Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

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Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
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Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
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Jarvis, Chas. L., Co., Middletown, Conn.
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Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Iroquois Corp., RFD 4 Box 331, 1800 E. 11 Mile Rd., Royal Oak, Mich.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Winter Bros. Co., Rochester, Mich.
Wood & Spencer Co., 1930 E. 61st St., Cleveland, Ohio.

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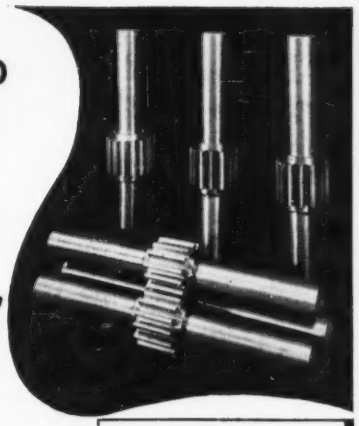
THREAD GAGES

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(*Continued on page 374*)

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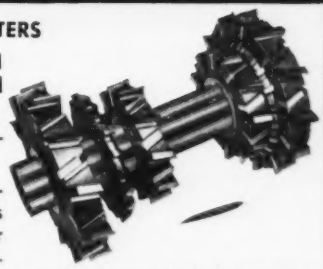
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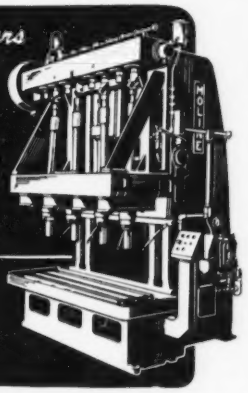
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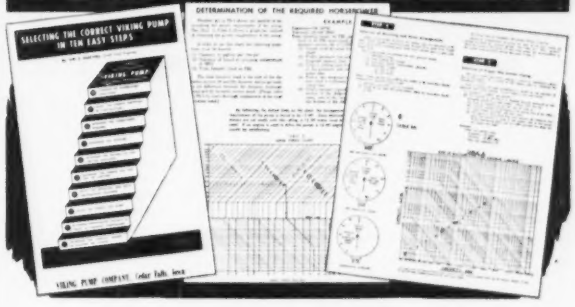
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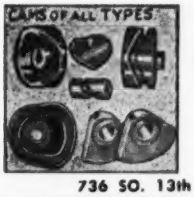
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Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
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Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
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Vanadium Alloys Steel Co., Latrobe, Pa.
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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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See Grinding Machines for Sharpening, Turning and Planning Tools.

TOOL GRINDING ATTACHMENTS

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Burg Tool Mfg. Co., 3743 Durango Ave., Los Angeles 34, Calif.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Michigan Tool Co., 7171 E. McNichols Rd. Detroit, Mich.
OK Tool Co., Milford, N. H.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
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Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
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Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

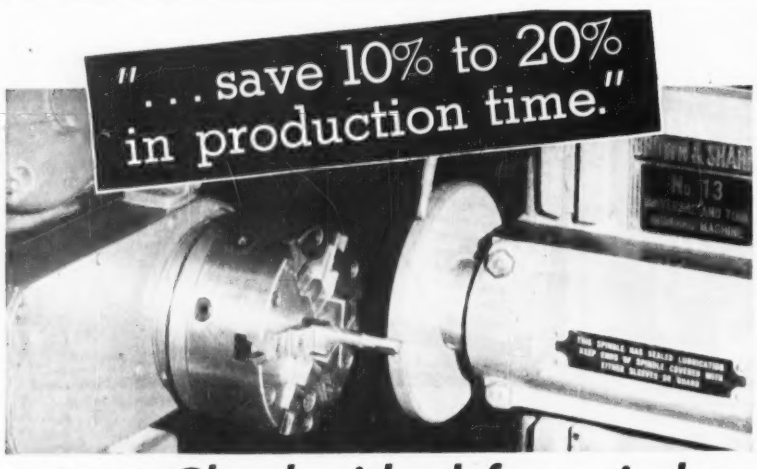
TOOLS, Carbide-Tipped

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Newcomer Products, Latrobe, Pa.
OK Tool Co., Milford, N. H.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

TOOLS, Lathe, Shaper and Planer

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Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Halpern, Wm., Co., Inc., 100 Stevens Ave., Mt. Vernon, N. Y.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
OK Tool Co., Milford, N. H.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.

(Continued on page 376)



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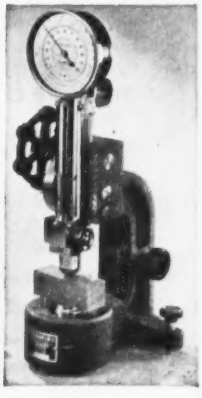
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Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
National Tube Div. U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Republic Steel Corp., Steel & Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh, 30, Pa.
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Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.

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Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadelphia, Pa.

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Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr.. Easton, Pa.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

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Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
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Barnes, John S., Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
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Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

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Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
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Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
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Bethlehem Steel Co., Bethlehem, Pa.
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U. S. Steel Corp., (American Steel & Wire Co. Div. Columbia Steel Co. Div., Tennessee Coal Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

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Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
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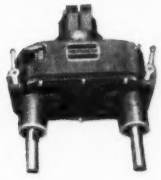
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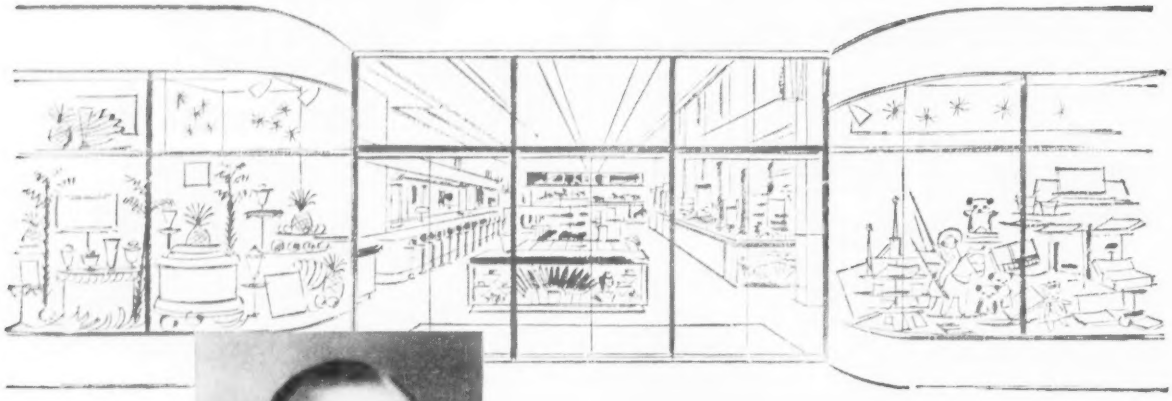
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6" x 30" Norton type C., hydraulic, 1941.
10" x 18" Cincinnati type ER, hyd., (3), 1946.
16" x 36" Norton type C., hyd., 1943.
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72" No. 72 Hanchett 3-hd rotary, 1946.

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14" x 46" centers Hendey tool room, serial 30869, new 1940.
14" x 28" x 36" centers Smith-Drum Gap lathe, new 1945.
No. 3A Warner & Swasey T/L, long bed, 1941.
No. H5 Libby International T/L, universal, 1942.
No. 5 Jones & Lamson T/L, universal (2), 1939.

MILLING MACHINES:
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No. 00 Sundstrand Hydraulic Rigidmill, m.d.
No. 3A Sundstrand Copy Rigidmill, m.d.
No. 1 S Sundstrand, m.d.
No. MM-1-6 E. S. Multi-Miller, m.d.
4" Pratt & Whitney Spline Miller, m.d.
18", 24" Cincinnati Plain Automatic, m.d.
24" Cincinnati Duplex Automatic, m.d.
24" Garvin Cam or Form Milling Machine, m.d.
No. 21 Brown & Sharpe Automatic, m.d.
30"x24"x12' Ingersoll Planer Type Milling Machine, m.d.
48"x16' Newton Slab Miller, m.d.
54"x30"x16' Ingersoll Slab Miller, m.d.
No. 3 Niles Cotter & Keyseat, m.d.
No. 3-30 Cincinnati Duplex Hydromatic Miller, m.d. in base

VERTICAL MILLING MACHINES

No. 18 Sundstrand, m.d.
No. 1-14 Kent Owens, m.d.
No. 08 Cincinnati, m.d., latest
Newton Vertical Miller, rotary table
54" Ingersoll Single Spindle Adjustable Rotary Mill, m.d.
54" Ingersoll two spindle Rotary Mill, m.d.
No. 4 Cincinnati Vertical High Power, m.d., Timken
4 spindle 360 degree Cincinnati Automatic Profiling Machine, m.d.

MILLING MACHINE ATTACHMENT

16" Cincinnati Circular Milling Table, p.f.
16" Kearney & Trecker Rotary Table, p.f.
20" Cincinnati Power Feed Rotary Table
Kearney & Trecker Attach. for Milling Bridge Reamers, 62" long x 24" wide
1¼" Cincinnati Rack Milling Attachment for No. 3 Dial Type Miller
Vertical Attachment for Milwaukee Mfg. Type Miller
Rack Cutting Attachment for No. 4 Cinti. H.P. Rect. Overarm Miller
Brown & Sharpe Vertical Attachment
Cincinnati Universal Vertical Milling Attachment for No. 5 Miller

PIPE MACHINES

2" Forbes Type Curtis & Curtis Pipe Machine, m.d.
No. 326 Oster Bolt & Pipe Thread Machine, m.d.

PRESSES

100 ton Wood Hydraulic Press, four col., single action
100 ton Chambersburg Hydraulic
400 ton Niles-Bement-Pond Wheel Press, m.d.
600 ton Niles-Bement-Pond Wheel Press, m.d.
Chambersburg 30 ton Hydro-pneumatic
No. 1 Robinson OBI flywheel vee belt, m.d.
No. 2 Robinson OBI Punch Press, flywheel type
No. 62 E. W. Bliss Duplex Press, m.d.

PUNCHES & SHEARS

No. 2 Hilles & Jones Horizontal Punch, m.d.
No. 6 Long & Allstatter Single End, m.d.
No. 7 Thomas Vertical, latest
No. 6½ Hilles & Jones Punch & Shear, single end, type G.
Cleveland Shear, 72" gap, 18" blade, 1" plate
72" gap Cleveland Plate Punch
Wiedemann Pneumatic Punch, bench model

SAWS

No. 4XB Robertson Economy Saw, m.d., new
No. 4B Robertson Economy Saw, m.d., new
Gustav Wagner Cold Saw, m.d.
Kolle Heavy Duty Steel & Metal Bandsaw, Model BSM-40, new
6x6" Racine Power Hack Saw, model 2C
6x6" Peerless Hack Saw

PLANERS

P10 Coulter Crank Type Shaper-Planer, 1 head, m.d.
20"x20"x5' Whitcomb-Blaisdell Planer, 1 Head, m.d.
24"x24"x6' G. A. Gray Planer, belted m.d., 1 head on cross rail
24"x24"x6' Cincinnati, belted m.d., 2 heads on cross rail
30"x30"x8' Cincinnati, belted m.d., 2 rail heads
30"x30"x10' Cincinnati, belted m.d., 2 heads
36"x36"x8' Cincinnati, m.d., 2 heads on rail
36"x36"x10' Betts, belted m.d., 2 heads on rail, 2 side heads
36"x36"x10' Gray, Extra Heavy Pattern, m.d., 2 heads on rail
36"x36"x10' Niles-Bement-Pond, belted m.d., 1 head on cross rail
36"x36"x12' Betts, m.d., 2 heads
36"x36"x18' Niles-Bement-Pont, 2 heads, variable speed m.d.
36"x36"x20' Cincinnati, 2 heads, belt
36"x36"x20' G. A. Gray, 2 heads, belt
36" widened to 42"x36"x20' Cincinnati, m.d., 2 rail heads, 1 side head
42"x42"x14' Niles-Bement-Pond, reversing m.d., 2 rail heads, 1 side head
42"x42"x26' G. A. Gray, 2 heads, belted m.d.
48"x48"x18' Niles-Bement-Pond, 2 heads, belt
48"x48"x18' Detrick & Harvey, 4 heads, reversing m.d.
48"x48"x28' Cincinnati, reversing m.d., 4 heads
56"x42"x14' Cincinnati, belted m.d., 2 heads

RAILROAD MACHINERY

No. 2 Niles-Bement-Pond Axle Lathe, m.d.
No. 3 Niles-Bement-Pond Axle Lathe, m.d.
48" Niles-Bement-Pond Car Wheel Borer, m.d.
90" Niles Balanced Quartering & Crank Pin Turning Machine, latest
90" Putnam Driving Wheel Lathe, m.d.
90" Niles Journal Lathe, including 2 inside journal turrets and 3½" spindle double quartering attachment, m.d.
90" Niles Driving Wheel Lathe, m.d., latest
Niles-Bement-Pond Quartering Machine, m.d., new

THE EASTERN MACHINERY COMPANY
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broken tools made like new again with **NU-TANGS**

Twisted or broken tangs replaced at low costs on any tool with a Morse Taper (sizes 1 to 6)

Hundreds of leading industries save money on drills, reamers, countersinks, cutters, drivers, the NU-TANG way.

Prompt delivery. Send for prices—or send tools for repairs. All work guaranteed.

NO WELDING! NO SLEEVES!
NO SHORTENING! NO DISTORTION!
GUARANTEED
STRONG AS NEW!

Send them to us like this! ★ *Patent No. 2,512,033* *We return them like this!*

NU-TANGS INC. 1335 Bates Avenue Cincinnati 25, Ohio

OK T-slot Bolts

The world's best one-piece, drop-forged—not welded—of mild carbon steel, heat-treated, with head accurately milled for standard tables on lathes, planers, boring mills, milling machines. Integral washer and nut. Sizes: up to 30". Typical direct prices for 10" lengths: ⅜—$1.36; ⅝—$1.58; ⅞—$1.89. Write for price list.

THE O.K. TOOL COMPANY, INC., MILFORD 6, N. H.

ELECTRIC FURNACE TO 1850°

with Auto Temperature Control. Sliding door. Cheap to operate. Substantial Dependable for Machine Shop, Tool Room.

8" x 12" x 15" inside 4.5 K.W. $250.00
12" x 16" x 20" inside 9.0 K.W. $500.00

E. H. WILLIAMS
BOX 9042D, HUNTINGTON, W. VA.

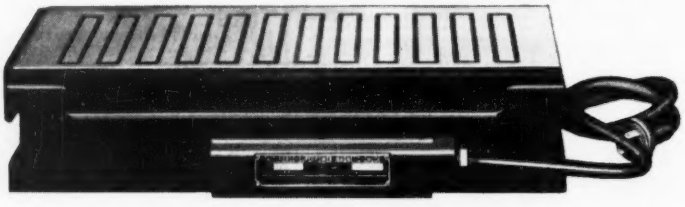
MACHINE TOOLS

4' x 15" col. CARLTON Motor on the Arm Radial Drill. 48 Spindle Speeds, 15 to 1500 RPM, A.C. M.D. Box table, coolant system, 1943.

FALK MACHINERY CO.
18 Ward Street — BA 5887 — Rochester, N. Y.

What's the difference between a PERMANENT MAGNET CHUCK and an ELECTRO-MAGNETIC CHUCK?





Which One Should You Use?

Some swear by one, some by the other — but there's a difference, both in the way they operate and in the holding jobs each does the best.

A *Taft-Peirce Superpower Permanent Magnet Chuck* has a built-in power supply of special alloy magnet material. Extremely powerful, yet controlled simply by moving a hand lever, the holding power won't fade with use.

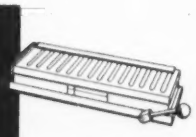
Since a Superpower P-M Chuck has no wires to fail — no current to heat — it's the safest, most economical choice for many jobs. Portable. Versatile. It's ideal for many grinding, light milling, planing, shaping, and benchwork jobs.

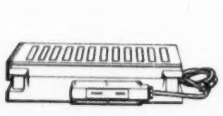
A *Taft-Peirce Superpower Electromagnetic Chuck* gets its power from a DC line. Slightly more powerful, size for size — it throws flux farther, gives greater flux penetration to permit mounting parts well above the face plate.

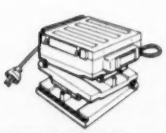
In addition, it is somewhat more adaptable to unusual holding problems where complex face plate design may be required, involving such elements as special contour, grooving, or slotting.

There are, of course, applications where one does a better job than the other. Since we make them both, we're completely impartial. We'd be glad to advise you which is the *best* solution to your problem. Write today. (And ask for Catalogs describing the many types and models available.)

T-P means Top Precision


PERMANENT MAGNET CHUCKS


RECTANGULAR ELECTRO-MAGNETIC CHUCKS


ADJUSTABLE ELECTRO-MAGNETIC CHUCKS


ROTARY ELECTRO-MAGNETIC CHUCKS

THE TAFT-PEIRCE MANUFACTURING COMPANY • WOONSOCKET, RHODE ISLAND

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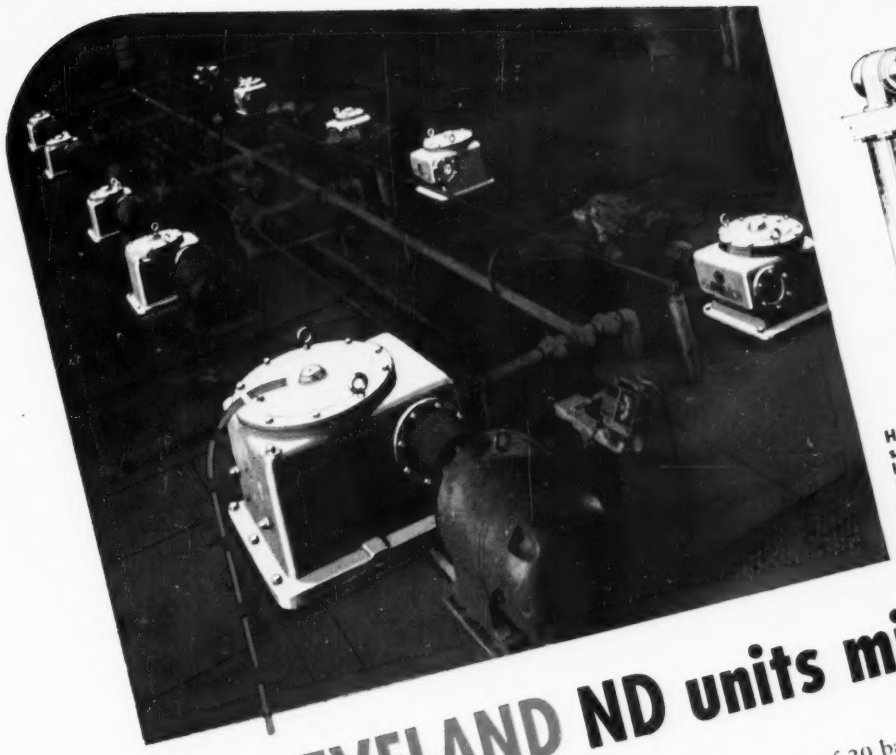
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How a large lacquer company saved space when it installed its Cleveland-driven mixers. The Cleveland ND drive is built with extra-rugged shaft bearings to take heavy, externally applied loads on the shaft. Photo courtesy of Grand Rapids Varnish Corporation.

Twenty CLEVELAND ND units mix lacquer

IN a Michigan lacquer factory, the agitators of 20 batch mixing tanks are driven by Cleveland vertical worm gear speed reducers. Motors and drives are mounted on one floor as shown in the photograph, with tanks suspended from the ceiling of the floor below.

This manufacturer chose Clevelands for his mixers because Clevelands transmit power so uniformly and smoothly. The mixing operation is always thorough and dependable. There are no unwelcome speed variations to upset production schedules

Smooth efficiency stems from Cleveland's case-hardened steel worms which run in perfect mesh with nickel-bronze gears. This long-wearing combination *actually improves with use*—a fact proven by the record of scores of Clevelands which actually have outlived the machines they drove.

Why not learn more about the advantages Clevelands offer? Write today for free Catalog 400. The Cleveland Worm and Gear Co., 3276 East 80th St., Cleveland 4, O.

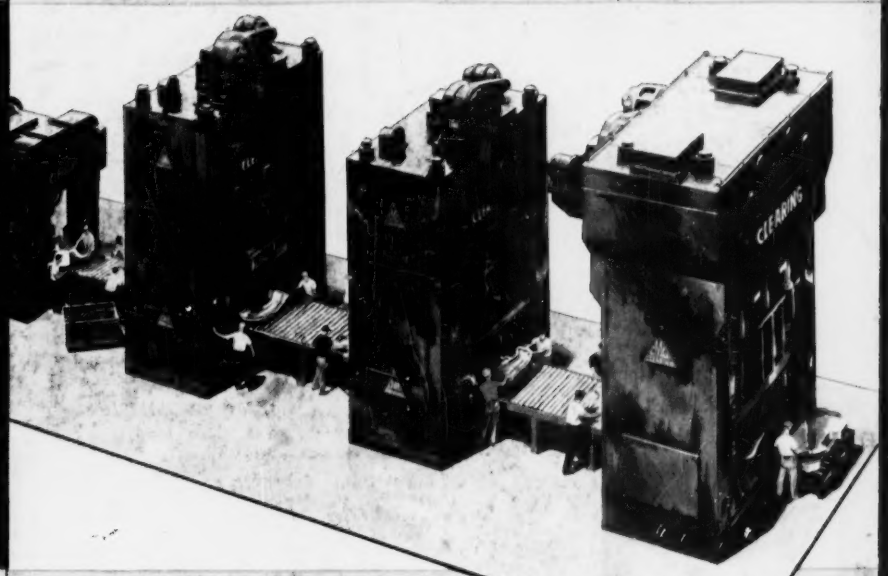
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CLEVELAND
Worm Gear
Speed Reducers

for a single press | or an entire stamping plant...





Plan for increased productivity with

There's only one way to beat the creeping paralysis of declining production. That's with planning—planning that combines realism with vision, experience with fresh ideas.

Clearing has geared its engineering efforts to the demands of the metalforming industry for higher productivity. Our staff of engineers have worked directly on hundreds of press installations—worked closely with the top firms in every branch of the metalforming industry. These men, *Clearing Productivity Consultants, are shirt-sleeve thinkers; they have ideas based on direct experience in the field. Their services are available to your organization to help you plan for increased productivity.

Whether your requirements call for a single press or an entire stamping plant, there is a C.P.C. ready to dig into your problem with you. Feel free to call on Clearing Machine Corporation today.

THE WAY TO EFFICIENT MASS PRODUCTION

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